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Automatic Feed Pump and Receiver.

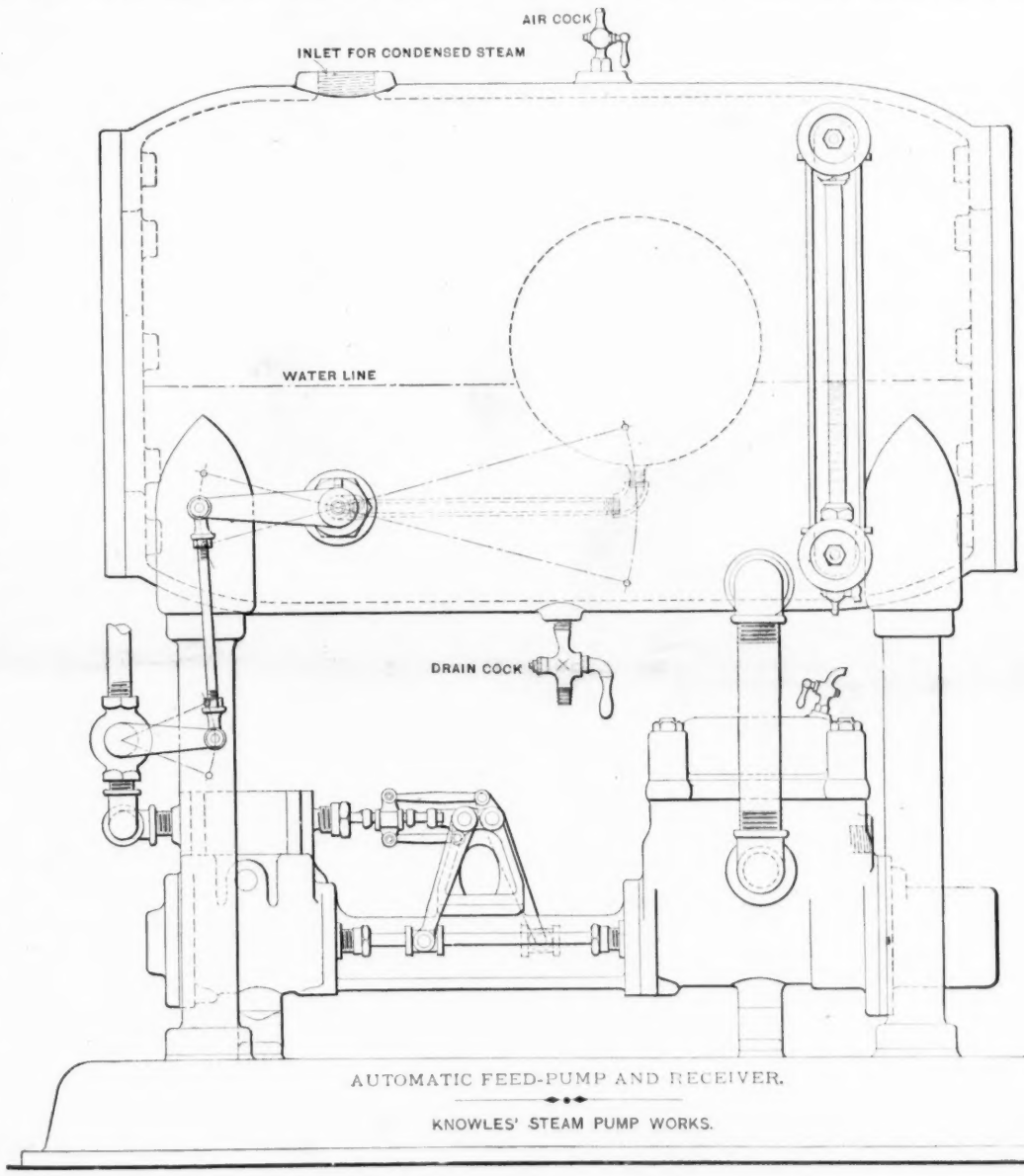
The device which we illustrate herewith is one recently brought out by the Knowles Steam Pump Works, Boston and New York. It is designed for draining coils, radiators, heaters, drying cylinders, steam jackets, etc., feeding the water of condensation in its hottest condition direct to the steam boiler, and as fast as it accumulates in the receiver, which, as will be seen, is situated above the pump.

The arrangement can equally well be used otherwise than to feed the water back to the boiler, as for regulating the circulation in refrigerating or cooling machinery and analogous purposes.

The operation may be described as follows: The condensed steam enters at the top, as indicated in the engraving, and gravitates to the bottom. As the water accumulates in the receiver, it raises the float, which, by the connections shown, opens the throttle, setting the pump in operation, carrying the water to the boiler, or elsewhere as determined. The throttle is balanced so as to present the least possible resistance to being moved by the float.

The pump will work faster or slower, in proportion to the amount of water flowing into the receiver. An increase in this quantity raises the float higher, opens the throttle wider, and increases the speed of pump; similarly, if a less quantity of water enters, the float drops and partially closes the throttle, correspondingly reducing the speed. This keeps the water level in the receiver practically constant. If the flow of water ceases, of course the pump will stop.

Copper floats, when used for purposes similar to this, frequently give trouble by filling with water. This is effectually provided against in the floats used with these devices, by putting the interior of the float in communication with the atmosphere, through the hollow stem shown by the dotted lines between float and valve lever.



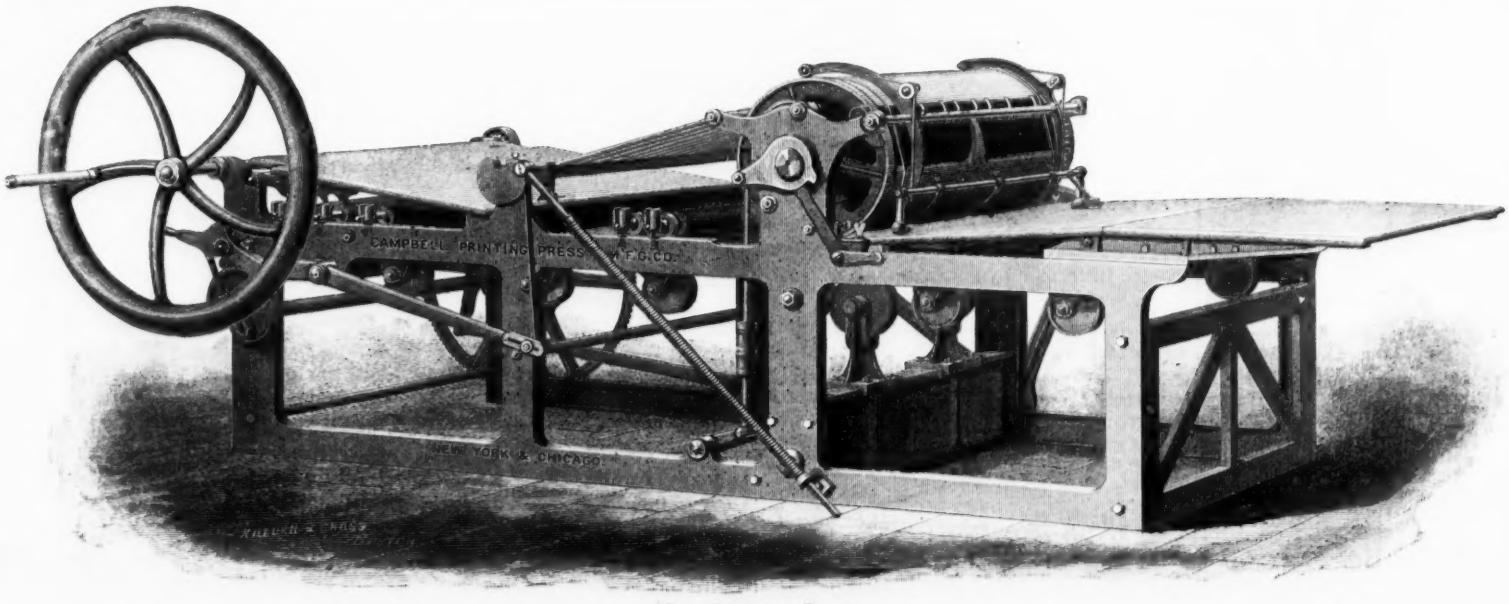
AUTOMATIC FEED-PUMP AND RECEIVER.

KNOWLES' STEAM PUMP WORKS.

New Printing Press.

The printing press shown in the illustration has recently been introduced by the Campbell Printing Press and Manufacturing Company, 160 William street, New York, and 300 Dearborn street, Chicago. It is intended for the use of country printing offices, and is adapted to newspaper or job work. It is one of a series of machines now in process of development from designs of the company's president and mechanician, John T. Hawkins. This press is constructed on the oscillating-cylinder principle, similar to the lithographic press which we have heretofore illustrated and described. As will be seen, the machine is simple in construction. The fly-wheel shaft carries a pinion on its free end which engages a larger gear-wheel. This carries a crank-pin, and, through a connecting-rod, a geared sector and a pinion on the end of the cylinder shaft—not in view—the cylinder is given about one revolution in each direction, the actuating parts being outside of the further side frame, and the strains incident thereto are transmitted through this side frame. The cylinder carries a gear-wheel on the further end, inside the frame, which engages a rack secured to the corresponding edge of the type-bed, and by this mechanism the bed is reciprocated and the cylinder oscillated always in exact union in that easy and quiet manner peculiar to the common crank, avoiding all necessity for buffer-springs to absorb the momentum of the reciprocating parts at the termination of the strokes.

The cylinder axis runs in eccentric bushes journalled in the side frames. These bushes each carry an arm to which is articulated a link, the lower ends of which are pivoted to a toggle-lever at either ends of a rock-shaft running across the press near the bottom. On the further side, this rock-shaft carries an arm which is actuated from a connecting-rod and a cam formed in the central part of the crank-gear—out of view in the cut—so as to



NEW PRINTING PRESS.

raise and lower the cylinder from and to the form at the proper time. The links are provided with long sleeved nuts, with right and left hand threads, by means of which the pressure of the cylinder upon the form is adjusted. The toggle-levers and links are brought into one straight line when the impression is on. The cylinder-shaft boxes also carry small lugs operating upon bent levers fulcrumed in the side frames, upon the short arms of which the front edge of the feed-board lies. In this way the feed-board is elevated and depressed at the proper times.

The method of delivering the sheet in this machine is novel. The sheet is fed to the under side of the cylinder, and, by the printing revolution of the cylinder, the tail edge of a full-sized sheet is carried up to such a height as to allow it to pass, at the commencement of the non-printing revolution of the cylinder, on to a set of stripper-fingers—not in view—thence, during the continuance of the non-printing revolution, down the inclined fly-fingers with the clean or unprinted side in contact with them, thus avoiding all smut or injury to the work. When the sheet has passed fully on to the fly-fingers, by means of a cam on the crank-gear shaft, the horizontal lever and vertical strap seen on the inner side of the press, a pulley on the end of the fly-shaft enwrapped by this strap, and the inclined spiral spring and rod—the fly is oscillated over upon the receiving-board, depositing the sheets thereon, the cylinder-grippers being opened at the proper time by a simple mechanism not in view.

To insure the invariable entrance of the tail of the sheet upon the stripper-fingers, there are pasted upon the "tympan," or cylinder cover, a series of loops of manilla paper or narrow strips of thick card-board, in such position that they will just escape contact with the tail end of the form, and spaced across the cylinder to escape the stripper-fingers. In passing over the furniture, quoins, chase, etc., if the paper loops are used, they may be more or less compressed. These loops or strips lie, when so adjusted, under the tail margin of the sheet, and elevate it sufficiently from the "tympan" surface to insure its passing on to the strippers, the strippers being set so as to just clear the "tympan" when the cylinder is up off the form and about to deliver the sheet.

To prevent the falling of short sheets back away from the cylinder during its retrograde revolution, the short, endless tapes seen in the cut are used, running partly in contact with the "tympan" over three leading pulleys, these pulleys being carried in two curved arms secured to a rod which extends across the press in front of the cylinder. The tapes are driven by contact with the "tympan," and are, of course, adjusted laterally on the cylinder so as to run on the unprinted margins of the sheet.

The rack side of the bed carries a guiding tongue which slides in a groove in the further side frame. The other edge of the bed does not touch the side frame.

The form rollers are so placed with reference to the motion of the bed that they run over the entire surface of the ink-plate, making the distribution very complete.

The design has been to produce in this machine a "Country" press of the utmost simplicity and at a minimum price, and one which can be erected, adjusted, and operated by unskilled men, and at the same time be competent to do accurate work of good quality and maintain its characteristics under long use. It is practically noiseless and capable of being operated either by hand or power; and from its construction, when run by hand, requires a minimum expenditure of energy in its operation.

The cylinder being directly geared to the bed, the surface velocity of the form and cylinder must be absolutely equal at all points of the stroke, and no matter how long the gearing may wear, this feature must obtain; hence the register, where not affected by questions of feeding, must always be as accurate as on the most expensive stop-cylinder machine.

The cylinder is particularly accessible for making ready. The fly and tape-arm rods are both lifted out by the slacking off, without removing, of three bolts. With this done, about four-fifths of the cylinder's surface is unobstructed. The fly-board hinges up into a vertical position to uncover the form at that end, and in that position has roller racks upon its under side in which to lay the angle distributing rollers. With the fly out and the feed-board turned up, therefore, the form is entirely accessible at that end of the press. The feed-board lifts off in two pieces, uncovering the form at that end. The bed runs on fourteen rollers of large diameter, twelve of which run upon studs in the side frames. The other two run in standards supported from the main cross girder which receives the strains of the impression, and, by means of eccentrical shafts, are elevated to regulate the reception of strain from the impression. The central bed rollers are so spaced that, in line with the axis of the cylinder, there are four with substantial wide faces which support the bed and form at four equally divided points.

The ink fountain is constructed upon an entirely new principle. It is so arranged that the blade and end pieces which, together with the roller, form the ink reservoir, may be separately disconnected by the mere slacking off of three bolts without removing them from their holes. In this way the entire fountain is quickly dismembered, so that it may be readily cleansed for change of color or other purposes. It may be easily and quickly re-assembled. This method of making the fountain also provides for adjustment of all wearing parts to prevent leakage of ink at the ends.

The press is built with the reversed ribbed frames, peculiar to several of the machines of this company, simulating a hollow-box frame in appearance, and giving to the machine a clean, smooth exterior and a very shapely appearance. It may be run by hand up to 800 per hour, and by power as high as 1,200, which is guaranteed.

Between the frames, under the bed—usually occupied by a more or less complicated actuating and reversing mechanism—there is absolutely nothing but the rollers upon which the type-bed runs; while the mechanism which performs the corresponding functions in this machine are of the simplest and most inexpensive and durable character.

A smart Galveston boy, coming to New York on one of the Mallory steamers, said to the engineer:

"You will get your discharge if you ain't ain't more careful."

"What for, sonny?"

"You forgot to wind up that clock; the hands haven't moved since we left Galveston," replied the youth, pointing to the steam gauge.—*Texas Siftings.*

New-Laying A "Slick."

By James F. Hobart.

"New-laying a millwright's slick" is often regarded as the great test of a blacksmith's skill, and to do a good job every time, in welding a piece of new cast-steel to the worn-out shank of an old chisel, is a good test of the edge-tool maker's value.

A "slick" is an invaluable tool for all framers of timber work, provided the make and temper is good; but it proves a most aggravating tool, when too soft, or too hard, or when burnt or full of fire-cracks.

The first act is to cut off the chisel, just above the steel, as in Fig. 1; *b* shows the end of the steel, and *c* represents the chisel after heating and cutting off.

By this time, the socket will have got heated very hot. Dip the chisel in the water tub until the cut end is cool; then take it in both hands, as in Fig. 2, and strike smartly on the corner of the anvil until the handle flies out, which it will probably do with very few blows.

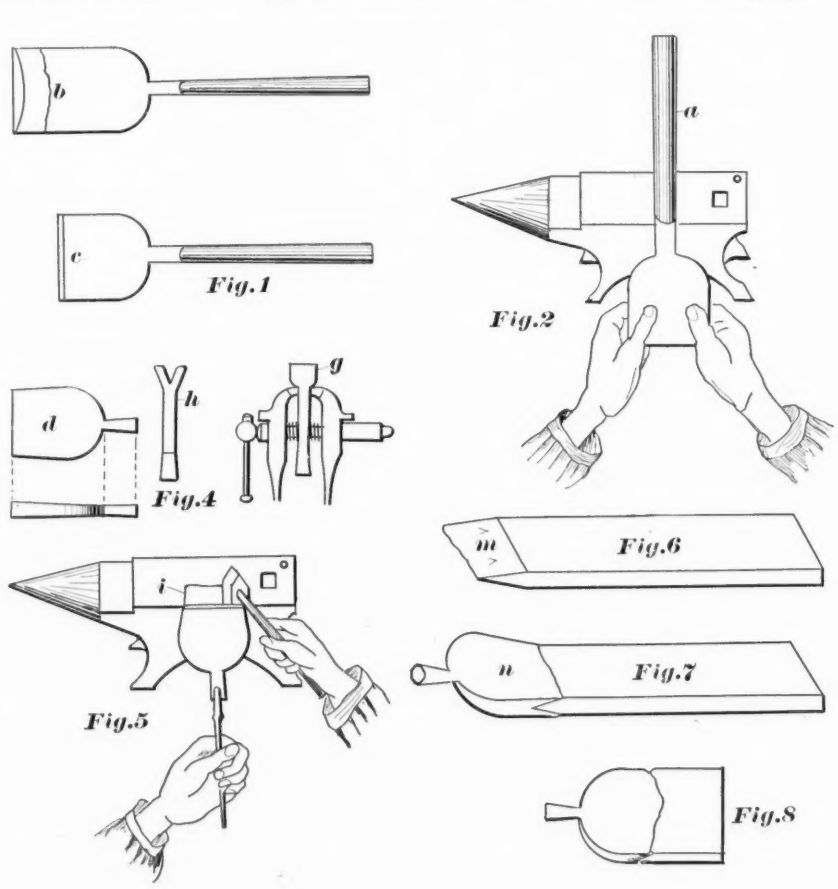
If the handle should refuse to start, do not risk splitting the socket by hard blows, but put the socket in the fire, taking care not to burn the handle; heat slightly, and try again, as before, when the handle will never fail to soon come out.

The next operation is to upset the chisel, and to narrow it down where cut off, as shown by *d*, Fig. 4. The width of the chisel must be reduced to equal that of the piece of steel from which the chisel is to be repaired.

If the chisel is 5 inches wide, and we want to use a bar of $\frac{3}{4}$x2$\frac{1}{2}$″ steel, we must narrow the chisel 1$\frac{1}{4}$″ on each side, and take care that it is at least as thick as the steel, and if possible, a little thicker, in order to secure good square corners after welding.

Put the chisel in a vise after taking a good heat, and upset like *g*, Fig. 4. Next, with a chisel, split the upset, like *h*, taking care to keep the split exactly in the middle, so that both sides may be of a thickness. After splitting open to an angle of 90 degrees, draw down each lip of the split, as at *i*, Fig. 5. After the lips are drawn nearly to feather edges, batter them back again, so that both sides of the chisel are nearly straight.

Take a heat on the piece of steel, and draw it out to fit the split left in the chisel. The steel will now look like Fig. 6, and with the corner of a sharp cold-chisel raise two or three barbs, on each side of the scarf, like *m*. These barbs will hold the steel firmly in the chisel, after it is driven in and the chisel lips hammered down on it, as at *n*, Fig. 7. The tongs can now be discarded, and the welding done while holding the steel in the hand.



New-Laying a "Slick."

Don't be afraid of using borax when making the weld. Use it freely, and keep the lap well covered with it. When beginning to heat, do not let the fire strike at once on the thin edges of the lap. Heat back on the steel; then draw the chisel toward you, and take a good heat at *n*. By thus doing but little heat will be necessary to bring the lap up to that bright yellow, "spluttering" heat at which cast steel will weld without burning, and at the same time the corners of the lap are not sacrificed by being burned off.

When hot, hammer lightly and quickly, beginning at the tip end of the steel, and working toward the ends of the thin iron edges. This ensures working out all the borax and oxide, which might otherwise cause bad flaws in the weld. Bear in mind that when hot, the union by hammering must be made almost instantly, and you will not be apt to get left with an imperfect weld, by neglecting to hammer certain parts until too late.

The beauty of welding a chisel is to make the weld at one heat. If you miss it and are obliged to patch up, a poor job is almost certainly the result. It is about like the man who was interrupted while eating his dinner. He "couldn't begin all over again," and he "couldn't tell just exactly where he left off," so he was obliged to "guess at it"; and so we must do with our weld, if we lose the first heat.

Bringing the corners up to a good weld, and keeping them full and sharp, is where the most failures are made. It *is* hard to do so, but it *can* be done, if you *know how*.

Fig. 8 shows the effect of burning off the corners, or of a poor weld at that place. The remedy is to drive a wedge of iron into the joint. Take another weld, and square up with the extra iron thus gained; or, to narrow down the chisel, upset it, and again plate it out until the corners have been brought into good shape. Either or both of these methods require time, and does no good to the quality of the job. It is much better to calculate just right the first time; then the job comes as you wish it, without further trouble.

Plate the chisel out to the desired width and length, grind up and harden, taking care to heat the *face* of the chisel the most, when so doing. Now draw the temper. A good clear fire, a chunk of red-hot iron, and a tub of clean, cool water, are all the appliances needed for drawing the temper in such a manner that three, or even four, inches may be ground off the end of the chisel, yet the temper remains the same.

The French railway companies are at last yielding to the pressure of public opinion, and increasing the speed of their trains, the train from Paris to Boulogne having reached a speed of forty-two miles per hour, which is considered marvelous. Nevertheless, they are most reluctant to accelerate their service, on account of the extra cost high speed entails, considering their pockets more than the convenience of the public. Holding the opinion that the tractive power required can be much reduced by increasing the size of the wheels, and that he cannot convince the companies of this without actual trial, a French private gentleman, M. Estrade, has had a locomotive, tender and train of carriages constructed to his ideas, which he proposes, shortly, to try on the Southern Railway. The locomotive has three coupled axles, the wheels being all 2m. 500 (8 ft. 2$\frac{1}{2}$ in.) in diameter, and has cylinders 19 in. diameter and 28 in. stroke, weighing, in working order, about 42 tons. The carriages have two axles and wheels of the same enormous diameter, with 15 ft. wheel base. The great height of the axle and wheel necessitates, of course, a different construction, the carriages being in two stories, with lower compartments at the ends and between the wheels, and an upper floor reached by staircases at the ends.—*Mechanical World.*

The Jersey City *Evening Journal* displays a broad sense of humor when it refers to the plumber's recent labor troubles as a "Strike of the millionaires."

Machine-Shop Time and Cost Accounts.

By A. J. Shaw.

The problem of keeping accurate cost accounts is too often neglected, even in shops which are fairly well managed, and in the large majority, as far as the writer's observation has extended, a solution is attempted only in the crudest and most primitive manner. This statement is especially true of the smaller shops, in which the cost of stock and manufactured work is nearly always an unknown quantity, except in a general way.

In the average machine shop, employing, say, fifty or a less number of men, the general process of keeping the time and cost account is something like this:

Every morning the foreman, clerk or timekeeper goes to each man in the works and obtains from him, verbally or from his "slate," an account of his "time" for the preceding day—so many hours on "Smith's engine," it may be, and so much time on repairs for Jones & Co., all of which is duly entered in the blotter.

From this blotter, if there be a regular bookkeeper, the "time" is carried through the several books, and into the several accounts, in the lump, appearing in the cost book, if any is kept at all, as a total of —— hours on "Smith's engines," and so on for the various items.

This time may be planing, or turning, or fitting, but no one knows which, or on what part of the engine the labor is expended, after the account is transferred from the "blotter," although it may be, and often is, given there in full. Neither does anything appear to indicate whether the work is done by a machinist earning $3 a day or by an apprentice receiving as much per week. So that if, when the machine is finished, there appear on the cost books entries indicating the number of hours of labor expended, it is impossible to ascertain from them anything like the *actual cost* of the machine or article in question.

Where books are kept in this way, the Gordian knot is usually cut by assuming all the labor in the shop at some rate which is supposed to cover and include its cost, and the margin necessary to insure a profit.

In some cases a subdivision is made distinguishing between machine and floor hands, pattern-makers and smiths.

In many of the smaller shops, where the accounts are kept by the proprietor or foreman, not even this much is attempted, the only items transferred from the "blotter" to the day book and ledger being those items of personal account which are chargeable to customers, while everything concerning cost of management, of stock, work, repairs and general expenses, remains buried in the blotter, from which it is never resurrected.

It is true that when the shop makes a line of goods that it keeps in stock, or for which it has a stated price, "time" is usually taken on the first lot, occasionally on the second, and the total number of hours multiplied by the regular "jobbing" rate, from which the manager estimates his selling price, or, if there be competition, ascertains whether at ruling rate he is "coming out whole."

After this, time is not usually worked up, the first result being considered all-sufficient and conclusive.

The keeping of accurate cost accounts is thought to be such a formidable matter, even when there is any conception of their value and importance, that it is seldom undertaken, or, if attempted, is soon abandoned, with very much the same feeling that would be experienced in giving up a Sphinx riddle.

In reality, the problem is not a complicated one if approached in the right manner.

There are three leading requirements to be borne in mind in devising a system of time and cost accounts for any business, and these, in the order of their relative importance, are: 1st, accuracy; 2d, comprehensiveness and flexibility; and 3d, clearness, which almost necessarily implies conciseness and simplicity.

The first is indispensable, as, if the accounts are not reasonably accurate, it were better not to keep them, for they would mislead instead of guide.

They must be sufficiently comprehensive to be applicable to any and every article manufactured or made in the shop keeping them, and not only must they record the cost of the work in the lump, but must account for the individual details as far as may be in any instance desirable.

They must be so clear that the cost of any detail or collection of details, of which account is separately kept, can be found almost instantaneously in all its essential particulars, and they must be simple, and for a given result, involve the minimum of labor.

Probably a perfect system of time and cost accounts has never, and will not soon be devised, nor does the writer conceive that he is presenting anything better than many of those already in use; but an experience with several systems, of one of which the following is a modification, designed especially to reduce and simplify the clerical labor as far as possible, encourages him to think that some may find it useful.

The system starts with the assumption that where possible the cost of work should be kept by "piece" and not by weight; although some classes of heavy work can be kept and estimates made more easily on the basis of a weight classification. To this requirement the system, with some changes in detail, is as well adapted as to the other. But even when weight classification is used for the purpose of estimating on new work, the cost of that same work is best kept by "piece."

This demands that the cost of the separate parts of the machine or article in question should be traced in detail, and how far this is desirable is to be decided fo

Gross, Shaw & Co. Time bill of.....for week ending.....188...

Foreman.

S.	M.	T.	W.	T.	F.	Total.	Cost.		Operation.	No. and Name of Pieces.	Charge to

Approved,

Totals. Received payment,

Fig. 1.

R. Gardner & Son. Date. .....188.....A. M. to.....P. M. Name. ..... Number. .....

Time.	Class of Work.	No. of Pieces.	Name of Piece of Worked On.	For Whom.	Stock, etc.

Fig. 2.

		MATERIALS.						LABOR.								
Pc. No.	Name of Piece.	No.	Wt.	Materials.	Rate.	Cost.		Lathe	P & M	D & B	V & F	Sunds.	Tot.	Cost.	Totals.	
16	Spindles.	6	Lbs 190	M S. Forging	11	20	90	139	50	12	46	30	277	112 30	133	20

Fig. 5.

Headstocks for 6-inch Lathes; Order No. 2,147.

6 Spindles (16).									6 Cones, 18 Pcs.									6 Sets Headstock Gears.								
Date.	Lathe Work.	Planing and Milling.*	Drilling and Boring.	Vise-Bench Fitting, etc.	Grinding.	Costs.		Date.	Lathe Work.	Planing and Milling.*	Drilling and Boring.	Vise-Bench Fitting, etc.	Polishing.	Costs.		Date.	Lathe Work.	Planing and Milling.*	Drilling and Boring.	Vise-Bench Fitting, etc.		Costs.	
188 Jan. 6	.25 9	....	....	....	....	2	25	188 Jan 13	.26 36	....	....	....	....	9	36	188 Jan. 20	.25 45	....	....	....	....	11	25
13	20	....	....	....	....	15	....	20	60	....	....	....	....	15	60	27	60	.06 50	....	....	....	18	....
20	60	.22½ 30	.224 10	....	....	24	....	..	.25 35	.20 15	....	....	....	11	75	.....	105	50	....	....	....	29	25
27	10	20	2	.30 46	.27½ 30	29	50	27	.....	.....	.22½ 21	.27½ 30	.15 12	14	78	.....	155	@	....	....	15	23	25
.....	139	50	12	46	30	70	75	.....	131	15	21	30	12	51	49	.....	.....	.....	.....	.....	.....	52	50
.....	277	@	.15	=	....	41	55	.....	209	@	15	....	....	31	35	.....	.....	.....	.....	.....	.....	.....	....
.....	.....	.....	.....	.....	.....	112	30	.....	.....	.....	.....	.....	.....	82	84	.....	.....	.....	.....	.....	.....	.....	....

Fig. 4.

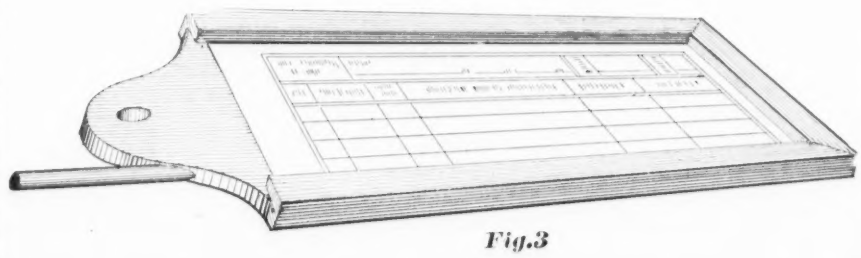


Fig.3

To reduce clerical labor, each employe keeps account of his own "time" on a card of permanent record, which card is one page of the "blotter" day book.

The arrangement of this card varies somewhat with the class of business and the size of the shop, but should be in all cases as simple as possible, while presenting a complete record.

Of the two examples given, the first, Fig. 1, is one which the writer devised for and used in a small manufacturing shop, and was intended to serve the multiple purpose of time book, day book, and pay receipt.

The method of use was this: Saturday morning the foreman gave a card to each employe, taking in exchange the card for the preceding week. He then examined and verified the charges, signed the cards as approved, and handed them into the office, with such additions and explanations as might be necessary. It will be noticed that the working week begun on Saturday, on which day the workmen were paid up to the night immediately preceding. As this limited the time for making up the pay roll to a few hours, the day columns, only, were footed, and the total, multiplied by the workman's rate, written at the foot of the column headed "Cost." From this payment was made and receipted for. The columns headed "Total" and "Cost" were afterwards made up, and thence the accounts transferred to the books. After all charges had been drawn off the cards were bound by the long stubs at the left, and filed away as the book of original entry.

The posting of the shop accounts but once for each week greatly reduces the clerical labor required for keeping the books, and the writer does not believe that for a manufacturing business of moderate magnitude it is necessary to do so more frequently, but in a shop doing a miscellaneous and jobbing business, the cards would require modification, as in that case they should be taken up each day. For this the writer has used the form shown in Fig. 2, which is so clear as to require no explanation. The weekly card was 6½x10½ inches, while the daily card measured 4x11¼ inches. The material was a good quality of manilla wrapping paper of medium weight which, while rough enough to present an excellent surface for writing in pencil, was at the same time sufficiently smooth to permit of entries in ink.

In order to keep the cards clean, and as a matter of convenience, each workman was provided with a time board, Fig. 3, and a pencil, which was kept in a pocket band to receive it, and from which, in the cut, it is seen projecting.

By those who have not used it, an objection may be made to the time card system on the ground that a great deal of unnecessary time will be consumed by the men in making their charges, which will, in the aggregate, much more than balance the gain of time in the office. An experience with them in these shops, in all of which the other system had been in use, has convinced the writer that this objection has no foundation in fact, and that the loss of time is no greater than in making the memoranda on slates or loose pieces of paper in the old way.

From the cards, all manufacturing and contract jobs were transferred directly to the "Cost Book," a part of a page of which is shown in Fig. 4, with entries to show the manner of making up the accounts. As this page is devoted to cost of labor only, there are no entries of materials; they being entered in the stock columns of the final summary, in which forgings are entered as stock at a rate determined for each class.

The small figures above and to the right of the hour entries denote the workman's rate of pay per hour, at which rate the time is carried out.

When the rate figure is omitted it is understood to be the same as that of the charge above, and when two men, at different rates, are at work on the same operation, each man's time is entered independently, as in the entry of January 20—lathe work on cones. All entries on the same horizontal line are carried into the "Cost" column in the aggregate.

In manufacturing shops it is frequently the case that one man runs two or more machines on different jobs or different parts of the same job, at the same time, and charges to the various items "machine time," which may aggregate two, three or four times the number of hours for which he is paid.

These "machine hours" should be entered in the cost book at a reduced rate, which is to the workman's rate of pay, as is the total number of "machine hours" to the number of hours worked by him.

For example, in the entry of January 27, headstock gears, under "planing and milling," the total number of machine hours charged on all work on the workman's card was, we will say, 175, he working 60 hours at $1.75 per day; $\frac{60}{175}$ of $1.75 gives .06 as the rate to be charged for the 50 hours time cutting gears.

With the exception above noted, all day work is carried into the "Cost" column at the rate paid the employe, and to its footing on completion of the machine is added the cost of superintendence, interest, depreciation and the various items which make up the general expense account.

This is computed on the basis of the total hours of labor, to which, in any given establishment, it bears a reasonably constant ratio; and in the examples given it is assumed at 15 cents per hour.

This ratio varies, of course, with the volume of business, decreasing as the volume increases, and *vice versa*, but on the cost books may, and should, be taken as constant, being based on the average business of the shop.

The entries given on the specimen page of the cost book, are illustrative only, and are not to be taken as indicative in any respect.

From the cost book page, Fig. 4, the totals are transferred to the "Cost Summary," Fig. 5, which is intended to epitomize the cost of each item, and of the whole machine.

This is the book of final entry as far as the cost accounts referring to the individual machines are concerned, and by reference to it may be found at a glance almost any information likely be required concerning the cost of the machine or its component parts.

The "new man" in a shop is always closely observed. Everything is strange to him, and he exposes his weak and strong points while he wrestles with the "off points" of the various tools and appliances in the shop.

The men size up the new man by the way he takes hold, and the foreman cannot be told in plainer language of the capabilities the man is possessed of.

Don't watch the new man too much. The manner in which he "finds the shop kinks," will tell just what he is worth.

Furnace for Heating Long Bars.

By W. G. Richards.

The idea was suggested by inspection of a furnace, five or six feet in length, with a door at each end; and a continuous grate, built by Donald McLeod, of Providence, R. I. Trouble had been experienced in securing a uniform degree of heat on bars eight feet long, having one to four inches cross section. The length of bars having been increased to sixteen feet, this furnace was designed and constructed, with results entirely satisfactory, an even degree of heat being obtained the entire length of bars, with less fuel than was required with the small furnace first in use.

Fig. 1 is a longitudinal section, Fig. 2 a transverse section at *A B*, and Fig. 3 an elevation of front end. The close section lines represent the fire-brick lining; open section lines represent backing of common brick. There are three grates, 30″x30″, connected by flues *K K*. The heating chamber is 16″ high in center, 30″ wide, and 17 feet in length. The floor of heating chamber is constructed of tiles, 30″ long, 12″ wide and 4½″ thick, resting on blocks, 3″ high by 4″ wide, placed at the joints, and leaving flues *E*, 8″ wide, through which the products of combustion pass upward to the heating chamber.

In the arch over heating chamber are five vertical flues, 6″x9″, connecting with short, horizontal flues *L*, 4½″x12″, the last opening into the main flue, about 16″ square, which extends the entire length of furnace near the top and is then carried upward to a connection with the stack of boiler house.

In the short horizontal flues are placed dampers *G*, made of fire-clay, and bound with iron. By adjusting these dampers, the heat is evenly distributed, and under perfect control.

The opening *F* in front end, 3″x30″, covered by a counterbalanced sliding door, is for inserting the bars. The construction is such that the end wall of heating chamber can be removed for convenience in making repairs. In one side of heating chamber are five openings *H*, 5″x1½″, having a swing cover on outside. Through these openings, the heating chamber and contents can be observed at any time.

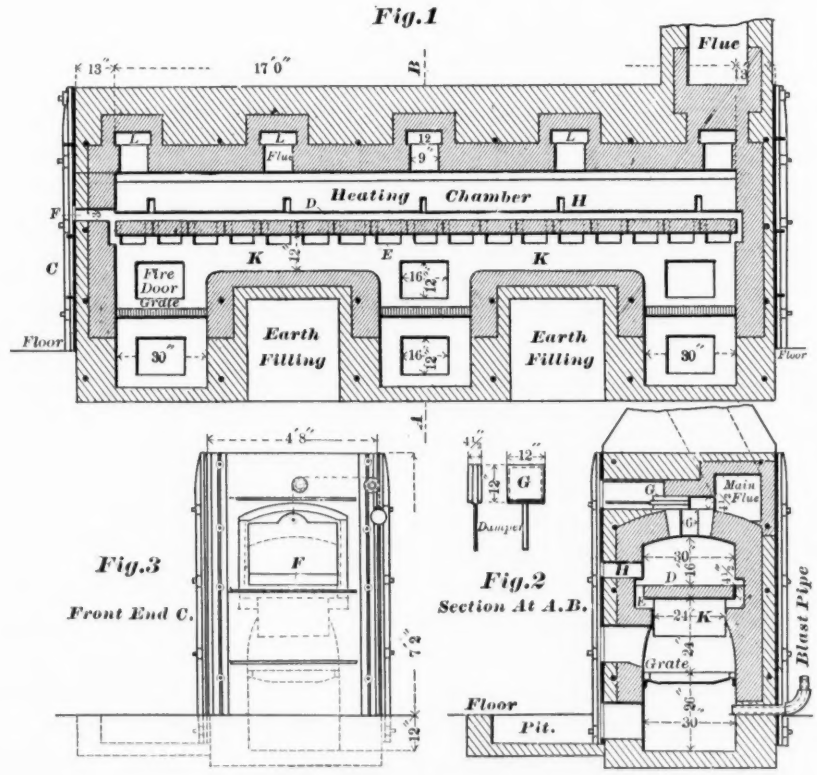
The blast pipes shown at the back were omitted, but if the draft were light, would be required. With a blast, a welding heat could easily be obtained.

The vertical flues in arch were formed in a tile having a plane surface at top, which forms a seat for the dampers. As it was necessary to have the floor tile made to order, the flue tile, dampers and skew-backs were made also; but with the exception of the first, the entire furnace might have been constructed of brick commonly found in stock. When short bars are to be heated, but two or even one fire need be used, as the dampers will confine the heat at one end.

It is an excellent arrangement for tempering large pieces of steel, or small pieces in quantity may be heated to any degree desired.

Some fears were expressed that the floor of heating chamber would not support a sufficient weight; but it has been covered with bars of iron, with no injury. The sides of furnace, where exposed to the greatest heat, were covered with plates of iron, binders placed over all, and well secured with tie-rods. After being in use six months, no cracks were visible, the furnace being apparently in as good condition as when first completed.

Fig. 1



Furnace for Heating Long Bars.

Good Nature.

One disagreeable man can cause ill feeling among a great many men, and make work unpleasant to all his shopmates. A man may not intend to cause hard feelings, but a hasty word gives offence when none is intended.

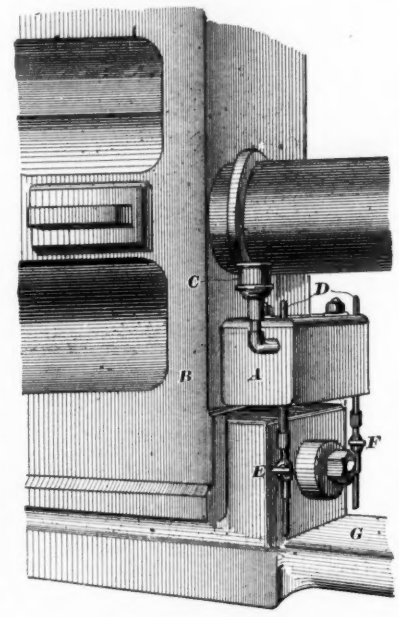
But very little care would be necessary to twist the gruff word into a joke or a pleasant take-off, which would cause a general laugh. Then, everybody would pass the affair with a smile instead of a growl, and the author of the remark would be called a "good fellow," when if he had used the hard words he would be dubbed an old grump, the whole shop seem full of fight and hard feelings, and the work would go hard for a long time.

It don't cost anything to keep a pleasant feeling in the shop. Two or three pleasant words, well placed, will make everybody in the shop seem full of good feeling, the work "goes ahead" with dispatch, and everybody feels good-natured.

Guide Bar Oiler.

A device which can be bolted to the crosshead of an engine, and which will thoroughly lubricate the guides, is illustrated below.

The box *A* is made of cast-iron, cored out inside, and planed outside. It is large enough to hold about one quart of oil.



Guide Bar Oiler.

This box is secured to the crosshead *B* by bolts which are accessible when the cover is removed.

The bolts *D D* serve to secure the cover of this box, At *C* a funnel in the shape of an ordinary oil cup, is connected with the box by a small pipe, and is used for filling the box with oil.

The slide is seen at *G*, and two valves *E* and *F* serve to regulate the flow of oil which comes through short pipes from the bottom of the oil box. Pine plugs are inserted in the lower ends of the valves, and serve to convey the oil direct to the guide *G*. Without these plugs, the oil would be spattered on cross head and floor, by the rapid movement of the cross-head.

This device is the invention of Thomas Strickland, engineer of Hoboken Cable Road. The device is not patented, and may be seen in operation on one of the large Watts-Campbell Corliss engines which drive the cable of the above named road.

Put the largest gear on the leading screw when fine threads are to be cut, but put it on the spindle when you desire to cut a thread of a coarser pitch than that of the leading screw.

Electricity for Practical Mechanics.

By George H. Benjamin.

During the past few years a gradually increasing amount of attention has been given to the subject of lighting by electricity, and, as the sequel thereto, the application of electricity to various manufacturing industries. There has consequently grown a desire for more intimate knowledge of the laws which its phenomena involves, as also the most economical and practical modes of applying electric energy.

Almost every engineer throughout the country is likely to be called upon to manage a plant of some description, and it is proper and fitting that he should have a reasonable amount of knowledge of the principles of operations, as well as the most advantageous method of handling the apparatus he is called upon to care for. A few years ago no one but a professed electrician would have been placed in charge of an electrical plant, but at the present time, owing to the increase in general information regarding electrical machinery, as also to the fact that the so-called or self-styled electricians proved to know little of electricity and less of mechanics, users have found it better and safer to intrust their machinery to the care and discretion of competent steam engineers.

That which is unknown is always terrible, is a trite saying, and applies with especial force to electric machinery. No one ever saw a current of electricity, and to the ignorant it is an intangible something which exists all around—not only in the dynamo machines, but also in the line, lamps, fixtures, etc.—and which, if you don't take care, will shock or kill you. Hence beginners are terribly afraid, and suffer both mentally and physically. Soon they find their mistake, grow bold, and as frequently go to the opposite extreme. A little knowledge would save them from either.

There is no inherent viciousness in an electric plant, and its care is not to be compared in point of danger with that of a plant of a sawing or framing mill. Even a high-tension Brush dynamo is less dangerous than a buzz saw. To get a little knowledge of the plant you have to handle is all that is required. The question which now arises is; How to get it? There's the trouble. I am compelled to admit that I do not know of a single book which a beginner—that is, one having no knowledge of the subject whatever—can take up, and which, commencing with the simplest principles and facts, will enable him, step by step, to gain the required knowledge. Unfortunately, most of our text and scientific books are written by "professors," college or school teachers. Practical men engaged in the daily arduous profession have little time to write. Text-books, as a rule, deal in theory. All very well for students; but practical men—daily wage-workers—must have something more. They want the deductions from theory—the sum of the knowledge—and its application. Given an axiomatic principle and its application, a reasoning man will soon find out the "why."

The first thing to be considered is the force that is to be dealt with—electricity; and here we meet with our first difficulty. What is electricity? No one ever saw it. What do we know about it? Nothing! How, then, can we deal with a force we know nothing about? Science is systematized knowledge; the science of electricity is systematized facts regarding its manifestations under different conditions. From these facts certain laws have been deduced, and, by properly comprehending and applying them, we are enabled to bring, in a measure, electric force under the control of man. For all practical purposes, a current of electricity (we have to deal also almost exclusively with electricity as a current) may be considered as a mode of motion—a force which, when transmitted through appropriate apparatus, will do work, mechanical and chemical—evidenced as heat, light and power.

It is somewhat difficult to comprehend an intangible force. The power to do work—of steam from a boiler, or from a suspended weight, or coiled spring—can be readily

understood. We see, so to speak, the power, and we know we can apply it, but with electricity it is different. A dynamo-electric machine at rest is simply a mass of iron and wire. Where does the power come from to produce such miraculous results? A steam boiler consumes coal in its furnace, heats the water and makes steam. The spring and weight must be wound up and energy expended. Here we have the analogy. To generate currents, we must expend energy; we must use steam through a steam engine to obtain the power to operate the dynamo. But why should the rotation of the armature of the dynamo generate electricity? No one knows! All we know is that such is the fact, and that for a given expenditure of energy—coal, steam engine, energy—we get back a certain percentage of electric energy in the form of current. The proportion of conversion of dynamic into electric energy depends upon the construction of the transmitting machine—just as some steam engines will give a higher efficiency for a given expenditure of steam than others.

In electricity, as in all other natural forces, the law of the conservation of energy holds good. Electricity, as before stated, is a mode of motion, and there can be no motion without a previous expenditure of energy of some sort. The energy expended is the power of the steam engine. It rotates the dynamo and sets the electric current in motion. The current can never have the same power to do work as the steam engine, as a certain amount of energy is wasted in transmission, making itself evident as heat. To make this plain—suppose a 10 horse-power engine is used to drive a dynamo and the electrical efficiency of the dynamo is 85 per cent—that is, for an expenditure of 10 horse-power of dynamic energy, we get a return of 8.5 horse-power of electrical energy, 1.5 horse-power being lost in transmission through the apparatus.

It is to be regretted that this law of conservation of energy is not better understood by the world at large. If it were, perpetual motion schemes, Keeley motors and other humbugs of a similar kind, would then have no chance to flourish. Remember that you cannot create power. You cannot lift yourself over a fence by tugging on your boot straps. You cannot get more power out of a machine than you put into it. Probably every engineer who has had anything to do with inventors has met the "perpetual motion man." He comes in various phases—of late electricity being the popular ism—he has an electric motor—greatest thing on earth—going to revolutionize the applications of power—put it on a street car—no horses—fortune made—great thing! After a time, you hear of a stock company; great number of shares—brilliant prospectus. The time comes when you have to test the "thing." Commercial efficiency 20 per cent. In other words, expend 10 horse-power to get 2 horse-power. Final collapse, of company; and so it goes, day after day; humbug, fools and their money, etc., and all because they will not believe the best settled and proved law of all science.

Profit-Sharing by Employes.

A year ago Blundell, Spence & Co., Hull and London, introduced into their business a new system, whereby their workmen, under certain conditions, should participate in the profits. Accordingly, one Saturday, the first annual division of the profits was made, and upwards of 300 of the hands became participants in the new system. It may be mentioned, however, that to become a participator, an employe must be at least twenty-two years of age on the day of distribution, have been continuously in the service of the company for two years immediately preceding that day, and not have been absent from his duties during those two years more than fifty working days, unless with the sanction of a managing director. The feasibility of the scheme was fully demonstrated by the fact that £963 2s. 9d. was distributed by the firm amongst 326 of their hands, 281 being in Hull and 41 in London. The gratuities having been awarded, a venerable servant of the company, named Holmes (who has been with Blundell, Spence & Co. since 1829), mounted on a barrel, and amidst cheering proposed a resolution, thanking Dr. Longstaff, chairman of the company, and the Board of Directors for having inaugurated the gratuity scheme, and assuring them and all members of the company that they would use every effort to further the interests of the business, and prove themselves worthy the consideration so kindly shown to them. The resolution having been cordially supported by other workmen, was then put, and carried amidst fresh cheers. The old man Holmes then called for three cheers for Dr. Longstaff and Mrs. Longstaff, which were given in ringing fashion, after which cheers were given for the directors and for the Messrs. Livingstone. — *The Ironmonger.*

Revolution Counter.

The Tabor Revolution Counter.

In this counter the outer dial is graduated from 0 to 100, and registers units; the inner dial is graduated from 0 to 50, and registers hundreds. This gives, when desirable, a continuous count of 5,000.

The reading on the inner dial is through the opening shown in the outer dial. Thus, if the reading on the inner dial is 45, and on the outer dial 25, the revolutions made will be 4525.

The three-cornered actuating point is held from engaging with the mechanism by a light spring. In use, this point is inserted in the shaft center, but not pressed forward sufficiently to overcome the tension of the spring. When the watch indicates even minutes, a slight forward pressure will engage the clutch and the registry will continue until the pressure is relieved.

To set to zero it is only necessary to pull out the spindle and slip one dial over the other, then push the spindle back and slip the index finger to the notch on the notch on the outer dial.

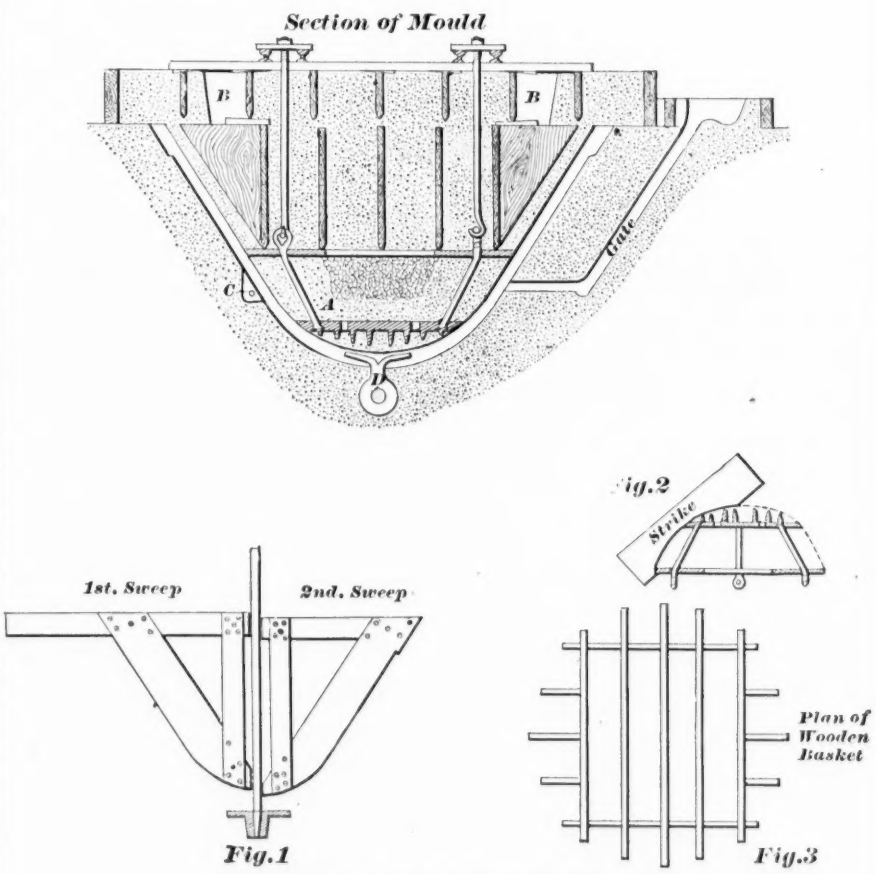
This counter is made by the Tabor Manufacturing Company, the general agents being Manning, Maxwell & Moore, 111 Liberty street, New York.

Moulding Bells for Blast Furnaces in Green Sand Without Patterns.

By George O. Vair.

Comparatively few years ago these castings were moulded almost entirely in loam, and some foundries still continue to use full patterns or sweep them up in loam; the plan herein described and shown, for sweeping them in green sand, involves small expense, and is far cheaper than loam castings.

The only rigging needed is the arbor shown in Fig. 2, on which dry sand core, *A*, is made, and the wooden "baskets," the plan of which is seen in Fig. 3. The cuts in Fig. 1 show wooden sweeps for sweeping the inside and outside of the mould. After sweeping up the shape of the inside of mould with first sweep, the dry sand core *A*, is put in, and, after nailing paper on the remainder of the joint to form a parting, the basket is set on top of the dry sand core and rammed up. The method of supporting and lifting the bulk of sand contained in the basket is so clearly shown in sectional view of mould that an explanation is not deemed necessary. The vacant spaces, as at *B B*, in the cope, are to admit of wedging between bars of the cope and those of basket; after the wedges are inserted, they can be rammed up with sand. The lugs *C*, of which there are two, are bedded in, their use being simply to support or hold the casting while it is being placed in position on the furnace. *D* is a wrought-iron "eye," cast in.



Moulding Bells for Blast Furnaces.

The size of this bell was seven feet at the mouth, and in depth three feet eight inches. Weight of casting, about 3,500 lbs.

The writer has made quite a number of those castings from full patterns and by sweeping, and always found the dry sand core, *A*, could be utilized to good advantage in either case, as it obviates the necessity of ramming up the most difficult portion of the cope or basket, and also invariably insures a first-class lift, and there is no danger of "cutting" when pouring the mould, as the iron strikes on the dry sand core.

In making bells of less size than the one here shown, the prickers on the core arbor were dispensed with, and the strike used in making the core was a common wooden straight-edge.

No sand being below the bottom plate of the arbor, which was merely well blackwashed, that being sufficient to keep the molten iron from adhering to it.

Wooden Emery Wheels.

What is the reason that my man cannot keep emery on his polishing wheels? asked a manufacturer. Although there are doubtless many causes which could only be determined by investigation of the case in hand, still we can, perhaps, present a few hints, which may help to remedy the defects.

First, the wheels must be properly made. To our knowledge, there is no material which equals mahogany for constructing polishing wheels. White pine is very good, and is in general use for this purpose

Select the pine with care, use only heart pieces, rejecting all split, "dozy," and hard, glassy appearing stock; and particularly avoid all sap, knotty, or unsound lumber.

Dress the pieces in a sharp, well adjusted cylinder planer, and take care that the feed roll is not weighted heavily: in which case, it compresses certain parts of the stock, which will swell under the influence of the hot glue subsequently used, and thereby will make a very poor wheel.

The stock had better be dressed to $\frac{1}{8}$ or $\frac{3}{16}$ of an inch, although $\frac{1}{4}$-inch answers very well, and even $\frac{1}{2}$-inch thicknesses are used in making thick wheels for rough work.

Having got the stock all ready, rig up a stick of timber so that it can be used as a lever wherewith to put a couple of tons pressure on the wheel after it is glued up. Perhaps, a screw may be contrived whereby the squeezing may be done, or a row of hand clamps may be screwed on all around the periphery of the wheel.

We have pressed a wheel with a 12 foot stick of timber, one end of which was placed under the sill of the shop, while the wheel, placed between two smooth planks, was used as a fulcrum, with the anvil set on the end of lever for a weight.

When ready to glue the pieces, which have been roughly worked out to about the right size, they are put in an oven or around a fire until they are thoroughly heated through and through.

Plenty of moderately thin glue (of the very best quality) should be spread quickly over the several pieces, which are then laid together with the grain running in different directions, and then transferred to the press before the glue gets cool, or sets.

Apply pressure until no more glue is forced out, then leave the wheel under pressure for four or five hours, or over night, taking care that it does not freeze.

When thoroughly dry, trim the wheel nearly to size and bore a hole for the spindle. It is well to face up one side of the wheel, then chuck it on a lathe face plate and bore the central hole while in this position. The wheel should be secured to the shaft by means of a well fitting cast-iron flange which extends entirely through the wheel, upon the shaft, the hole through wheel being bored to fit the flange, instead of the shaft.

This flange must be turned "all over," in order to be as true as possible. It is fastened to the shaft by means of a nut which works upon a thread cut on the shaft, forcing the flange against a collar on the shaft, and thus dispensing with both set screws and keys.

The object of all this trouble is to secure a true running wheel, which is not always done when set screws or keys are used for fastenings.

When the wheel has been turned nearly true in the lathe, it should be again turned after the flange has been well fitted and screwed into its place, and the wheel mounted on its shaft.

The sides of the wheel must be true, and if the wheel is not well balanced, it should be made so before the last turning. It is well to turn up the wheels and let them hang a week or two before covering them with emery. When this is done, the wheels should be again turned before putting on emery. For certain work, it is well to glue leather to the face of the wheel, and to glue the emery to this leather.

The leather may be put on with common glue, but the addition of $\frac{1}{3}$ fish glue (isinglass) will make a better job. If leather is applied, dry thoroughly and turn up true before covering with emery.

Spread some emery upon a board. Brush the face of the wheel quickly with *hot* glue, then roll it on the emery-covered board. Sprinkle more emery on the board, and roll the wheel until more emery does not adhere. Do not let the glue get on the board and stick emery thereto, to the detriment of the wheel. A wheel, covered in this manner, will, if laid one side until thoroughly dry, do a large amount of polishing before the emery gets worn off.

The fact must be borne in mind that the wheel here described *is not* a grinding wheel, and must not be used as such.

Its office is simply polishing; it may be called a "buffing" wheel and used as such. If this is to be done, instead of gluing on the emery, the wheel face is rubbed with tallow while the wheel is running, and the emery is then applied in the usual method. After thoroughly rolling the tallowed wheel on the emery-covered board, it will prove a benefit if the face of the wheel is lightly hammered with a broad-faced hammer. This seems to force the emery into the leather and keep it from being carried away when in use.

The tallow method applies only to very fine emery, and is used after the coarser grades have been applied. It may be supplemented by a wheel without any emery, the leather face serving to impart a very fine polish.

When the emery has been worn from a wheel to an extent that it is desirable to apply a new surface of emery, the remaining emery on the wheel must be removed by the judicious application of warm water. Very hot water will spoil the wheel by curling up the leather with which the wheel is covered, and if the wheel remains wet for any length of time it will cause the glue to soften and let the wheel come to pieces.

As soon as the emery becomes loose, it should be scraped off; all superfluous water carefully wiped from the wheel, which should be set on one side to dry.

When perfectly dry, the wheel may be returned sufficient to true it up, and may then be treated as a new wheel and another coat of emery put on in the method already described.

Pattern-making.

By F. W. Barrows.

SEVENTH PAPER.

PROPELLER WHEELS.

(SECOND PAPER.)

We will now lay out the first course, having dressed the stuff to a parallel thickness and out of wind. Get it out the same thickness as in drawing, Fig. 8. If the stuff is thicker than shown on this drawing, and is laid out by the templet, it will be too narrow, and for the same reason, if the stuff is dressed too thin, it will be too wide.

Turn the piece, for course, bottom side up; then lay out a circle the full size of hub on line between courses one and two. From the centre of this circle draw a radial line $b\ c$, Fig. 11. This line is the face of bucket. For the back face lay on the templet, being sure to have the center coincide with the center of course.

A good way to accomplish this is to bore a hole $\frac{1}{8}''$ diameter through the center of templet and also through the center of each course, then use a piece of wire that will fit this hole to center each course. Now bring the face of templet to the radial line $b\ c$, Fig. 11, and mark the width at circumference. The width at line $g\ h$, Fig 11, will be seen at $c\ d$, Fig. 13. The pitch at this point is shown by line $g\ h$, and the general outline of back side of blade by curved line $g\ i\ h$. As the blade tapers in thickness from this point to circumference the line of back should be curved from this point to end of blade like e, Fig. 11. Lay out the fillet between blade and hub as at f and K, draw a line $b\ m$ from center of hub to center of fillet; draw another circle the same diameter as end of hub. Then cut this course to the full lines, Fig. 11; mark the pitch and thickness on end of course as shown on end of templet, Fig. 10.

The pitch at any point between $g\ h$ Fig. 11, and circumference may be found as follows: Let $g\ h$, Fig. 13, be the pitch at $g\ h$, Fig. 11, and $e\ f$ the pitch at circumference $j\ K$, the center line and $g'\ m$ parallel with $j'\ K$, now divide the two lines $g\ e$, Fig. 13 and $g\ e$, Fig. 11, into an equal number of parts, a^1, a^2, a^3, a^4 and b^1, b^2, b^3, b^4. Now a line drawn from center p *to* b^4 will show the pitch line at corresponding point on first course as at a^4.

The first course is now ready except boring the hole for spindle. Be careful and bore this hole square through the course and large enough to fit spindle. The point l, Fig. 11, is located by the number of buckets; if for four the distance $l\ m$ is a little less than one-fourth of the circumference.

Now we have on this first course, lines showing the end of hub, the face of blade, the fillet connecting face of blade with hub, also the outline of hub on joint between one and two courses from l to m.

For the second course having dressed the stuff, lay on templet and bore small hole through center; mark along the face of templet and around the hub, also the width at

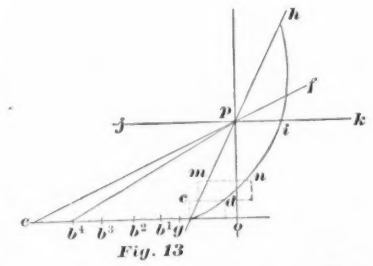


Fig. 13

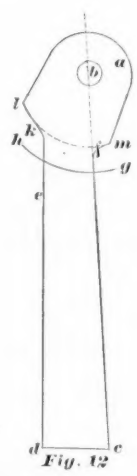


Fig. 12

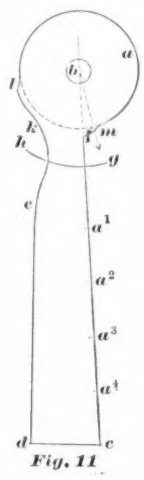


Fig. 11

Pattern Making.

circumference. Then remove the templet and draw a circle the size of hub on line between second and third courses; lay out the fillets and get the width on line $g\ h$, Fig. 12, as from m to n, Fig. 13. Now from the point m, Fig. 12, which marks the intersection of fillet and hub lay off a distance equal to $m\ l$, Fig. 11, draw lines from m and l, Fig. 12, tangent to circle a, then you have the second course, Fig. 12. Bore the hole for spindle and mark the pitch and thickness on end of course.

Turn up a hardwood plug or arbor to fit the hole bored for spindle, eight or ten inches long.

Lay the two courses now cut out, together, pushing the plug through both; then moving them until the face of second course exactly coincides with the point where the pitch line on end of first course meets the top surface of course. Then glue them strongly together using plenty of hand-screws.

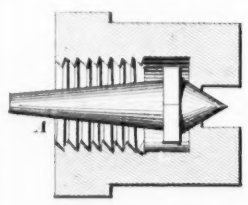


Fig. 1

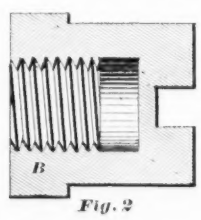
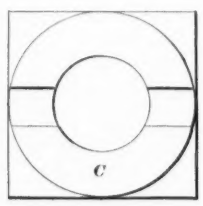


Fig. 2



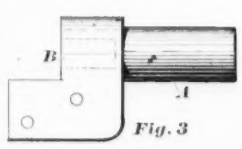


Fig. 3

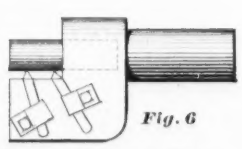


Fig. 6

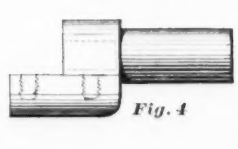


Fig. 4

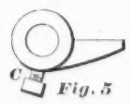


Fig. 5

Handy Machine Tools.

LETTERS FROM PRACTICAL MEN.

Some Handy Shop Tools.

Editor American Machinist:

I send you herewith a few kinks which are in daily use by me in course of my ordinary shop practice. Fig. 1, I call my riveting block, which is merely a piece of round cast-iron smaller at one end than at the other. I clamp it in the vise (it is six inches long) so that it projects far enough above the jaws to be convenient. I find that it makes a very useful tool for riveting. Sometimes I use one end and sometimes the other as the work requires.

Fig. 2 represents my chuck, dog, or carrier—latter name, perhaps, is the best—for flat cutters, reamers, etc. I use it mostly for turning flat reamers to a taper. A is intended to show it in place over the lathe spindle with center in, although I have not succeeded as well as I could wish with it in that position.

You will readily see that with the flat steel center A, placed in the slot across the face of the carrier, it drives from both sides. B is the section of carrier; C is the end view. In plain words, it is a cast iron carrier; round, save a square at the rear end to take off of the lathe width. It is fitted to the lathe same as a chuck; bored out to admit lathe center through it, and a little longer, say $\frac{1}{4}$-inch, than the distance from the shoulder of spindle to the point of center, with the slot across the center, as shown at C. The slots want to be deep enough to admit of movement of steel when turning taper reamers. I like it very well for such work, and hope I have made it clear.

Figs. 3, 4, 5 and 6 show a milling tool for use on turret lathes. It is a casting whose general shape can best be had from Figs. 3, 4 and 5, giving top, side and end views. A hole is bored in the center B, the shank having been turned to fit the turret. B is bored to receive the centering cutter, which keeps working through while the milling is being done; the cutter is held by set screw C, Fig. 5. Fig. 6 gives a general idea of the use of this tool, showing cutters in place. The milling cutters are merely flat pieces of steel held in place by clips, shown above, Fig. 6, offsetting the depth, or rather a little less than thickness of cutters. These clips are held by screws, as shown in Fig. 6. They are cheap and admit a large arrangement of adjustment. Center cutter can, of course, be made of any size. They are not patented.

Fred Colvin.

Engine Bearings.

Editor American Machinist:

A. R. speaks very positively on the engine bearing question and thinks my experience has been limited. In one sense it has been, as I have only been in the business thirty years, only eight of these being devoted to high rotative speed, and I think a man can be a student in both high and low speeds for fifty years, with advantage to himself and his customers or clients. I believe I spoke of engines running from 90 to 250 revolutions, and on shafts from $5\frac{1}{2}$ to 13 inches in diameter in a former article. I think I cited the ordinary pressures of steam, say, 75 to 100 pounds, and my proportion of crank-pin is intended to cover these ordinary conditions, being large enough for the contingency of a non-condensing engine being changed to condensing, the initial pressure remaining the same. I suppose A. R. intended to say 1,400 instead of 14,000 pounds per inch. I say that I have run a crank-pin under 1,800 pounds per inch without heating, though some people have beaten me by 250 pounds, and that on continuous running.

After reading A. R's remarks, I think it only fair that we should ask him for his proportions. I will therefore mention a case in actual practice. I built a double condensing engine about three years ago, cylinders 24″ by 36″, speed 110 revolutions per minute, steam chest pressure 75 pounds, developing 830 horse-power continuously for 130 hours, under a forfeiture for each half hour's delay, engine receiving full load two days after starting. How much and long would A. R. make the cross-head-pin, crank-pin and main bearing, and in what manner would he design and construct these parts for the service just mentioned? These engines are now running with from 750 to 825 horse-power daily, and never heat in the journals.

William H. Hoffman.

Providing a Center for Drawing Circles.

Editor American Machinist:

In the second article by Mr. Hobart on "Learning to Draw," he says:

In case of a center from which a great number of circles must be described, or which is to be used considerably, a thumb tack may be forced in and the needle point may be placed upon it.

The above method works well; but the great objection comes to light afterward, as when the tack is removed, a bad looking hole is left where the center should be, and renders useless any further attempt to use the center to lay off distances from.

A great improvement on the thumb tack is to touch the paper with a drop of mucilage and let it dry; or better, take a small square of gelatine, if it can be had, and stick it to the spot where the center comes. The gelatine can be removed after the drawing and tracing is made; and by a little moist washing, the adhering gelatine removed, leaving a small, neat center for future use. The mucilage can be removed in the same manner. There are special horn centers that can be bought, having three slight points merely sufficient to hold in place as long as in use.

Wm. H. Weightman.

A Disclaimer.

Editor American Machinist:

The old saying that "It's a wise child that knows its own father" may in the case of a child of the brain, be reversed so as to read, "It is a wise father that knows his own child."

Harry Hart, in your issue of March 20th, gives me credit for expressing a sentiment I never for a moment entertained, viz., that "thinking men are the exception rather than the rule." Nor can I discover anything in my letter of March 6th from which it would seem any one could draw such an inference. Neither can I discover or remember having ever used the expression he puts in quotation, "We might have done that ourselves." These may be my children, but Mr. Hart's story was too good and too valuable to have been marred by trotting in these prattlings, foreign as they were to the real body of the letter.

Mr. Hart certainly ought to have been happy once in his life, for getting out of such a job as he describes and shows just that kind of genius a mechanic has the best right to be proud of. I know very few ever get due credit or proportionate pay, so there is no other way to get satisfaction than to be jolly and smear one's buckwheat cake of a conscience with the golden syrup of self glorification.

John E. Sweet.

Railroad Shop Matters in Minneapolis and Brainerd.

The locomotive and car repair shops of the Chicago, Milwaukee and St. Paul Railroad, at Minneapolis, are quite busy, employing at present 600 men ten hours a day. During the winter they ran nine hours a day. When we visited the shops last week, eighteen engines were being repaired. They were of various styles of build, from the old fashioned brass-adorned engine to those of the most modern construction. A large part of the machines in the locomotive shop are of English build, purchased a few years ago when our machine-tool builders were overcrowded with orders. An English vertical engine, or pair of engines, with a large square-built frame, drives the shop, the cranks of the engines turning the shafting directly without belts. They are putting extension fire-boxes and straight stacks on all passenger engines that come in for general repairs. Engines on some of the divisions west of the Mississippi are much troubled with bad water. Flues become covered with scale, and fire-boxes incrusted. Boiler scaling compounds are used, but they do not obviate the difficulty. Experiments have been tried at Aberdeen, Dak., in filtering the water, with fair success.

The blacksmith shop has twenty-five forge fires. Several efforts have been made to keep the air in this shop free from gas and smoke. Exhaust fans were placed in the ventilating part of the roof. An underground air passage extends the whole length of the building into which gratings open. Fans were so placed as to draw the air through this passage and expel it through a pipe leading above the roof. Neither of these plans worked successfully, and both were abandoned. Now all forge hoods are made to raise and lower by means of weights so as to regulate the draft. Some of the forge chimneys (or sheet iron flues) are provided with elbows so as to run to openings in the center of the roof instead of being straight. This gives a better bracing and a stronger draft.

The locomotives and cars of eight of the twenty-two divisions of the road are repaired at these shops. Master Mechanic J. O. Pattee has charge of the locomotive department, and Master Car Builder E. A. Westcott of the car department. Mr. Westcott says there is considerable saving in repainting and repairing passenger cars that are drawn by locomotives having extension fire-boxes, over those drawn by the other locomotives. A lessening of sparks and cinders saves paint and woodwork. A new car finishing shop, 150x50 feet, will be erected this summer.

The general locomotive chart in master mechanic's office shows only name of builder and sizes of cylinders and driving wheels, but Mr. Pattee has prepared a special chart of all the engines on his eight divisions, which shows detailed dimensions of driving wheels, engine trucks, boiler and water space, and tender truck. This chart is always kept corrected to date. Weekly reports of the location and condition of engines are received, and the record is kept in a book instead of by colored disks on a check board. Monthly reports are received from each engineer in charge of an engine, detailing work done, supplies consumed and cost of repairs and supplies. These reports are interesting in the way of comparisons.

We observed printed copies of a new general order (dated Feb. 9) posted conspicuously about the shops. It is as follows:

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Employes will always be upheld by the company in refusing to use tools, machinery, rolling stock or appliances which are UNSAFE.

The general repair shops of the Minneapolis and St. Louis Railroad are in that part of Minneapolis known as Cedar Lake. They consist of a twelve-stall brick round-house, a frame building machine shop, another frame building for a blacksmith shop and a new brick car shop. The shops are spread out 100 feet apart, and power is communicated from the machine shop engine to the other shops by wire rope. When we were shown through the shops a few days ago several engines were undergoing repairs, and one was being built up anew from the foundation, using partly new material. It is a switch engine 16″x22″ cylinders, and 44″ drivers. There are seventy-two locomotives on the road, eleven of which have extension fire-boxes and straight stacks. Others will be so fitted. There are no brick arches in any of these engines. All the old iron pins are being taken out of locomotive driving wheels and steel pins put into their places. Old iron axles are being replaced by steel. Pistons are all solid, and piston-rods of steel. They use cast-iron guides exclusively instead of wrought-iron. Brass jibs are taken off crossheads whenever they come into the shop.

We noticed a 4″x3½″ vertical engine building, to be mounted upon a truck and used in different parts of the shop for boring out cylinders. A live steam pipe runs through the shop, to which connection will be made with an inch steam hose. The car shop has a capacity of 12 cars. At one end is the wood-working shop, 60x130 feet and two stories high. It is possible that a new paint shop may be built this summer, and that other improvements will be made. About 150 men are now employed in the shops which are in charge of Master Mechanic Wilson.

Premiums are awarded in the summer season on this road for the most economical locomotive running, there being three grades. We were kindly furnished a blank of the kind used for monthly reports of the operation of each locomotive on the line. It is very much in form like the reports of locomotive work on other Northwestern roads, and we reproduce the headings under which particulars are grouped. In summarizing the whole, wages of engineers, firemen, wipers and watchmen are added, and the average cost per mile run (for each kind of expense) figured out. A general average of miles run to a pint of oil and a ton of coal is also computed. A cord of wood is rated as a ton of coal, and switch engines are allowed six miles an hour.

The locomotive and car repair shops of the Northern Pacific Railroad at Brainerd, Minn., give employment at present to about 450 men (exclusive of foundry) nine hours a day. The foundry is leased to an outside party, who furnishes castings as ordered. The locomotive shops are in charge of Assistant Superintendent of Motive Power H. J. Small, and the car shops are in charge of Master Car Builder J. C. Barber. These gentlemen conducted us through their respective departments at the time of our visit, a week ago. A hundred locomotives used on the Minnesota division, run in these shops when repairs are needed. We noticed seven on the floor being partially overhauled. All locomotives on the line have the brick arch and the smoke consuming device, which consists of steam jets blown over the fire. Several are having extended fire boxes put on, but the straight smoke stack is not in favor, as it believed to facilitate rather than retard the throwing out of the sparks. Two templets are made to show the shape of every locomotive tire turned. Figures stamped upon the templets show date of turning, miles run since last turning, also thickness before and after turning. Templets are also made of tires when taken off. One set of templets is kept at the shops and the other sent to the superintendent of motive-power. The wheel gauge used on this line, which was illustrated in the AMERICAN MACHINIST September 20, 1884, shows whether wheels are placed correctly upon their axles so as to prevent cutting of flanges. We are informed that this gauge detects incorrect setting of wheels on many of the new cars when received from the builders. In such cases the wheels are moved to their proper positions upon the axles before the cars are used.

Work in these shops is done upon a well devised system, and such special and general tools are used as will best facilitate operations. We noticed in the tool room a set of Pratt & Whitney plug and ring gauges and caliper gauges. The check system is used for giving out tools. A large assortment of forged wrenches is kept for use, embracing open, hexagon box, square box and crowfoot. Each wrench is stamped with a number and a letter indicating its class. They are kept on partitioned shelves, fully labeled, and a complete list is posted in the tool room which is an index to the shelves and a description of each wrench. An attachment to a planer for planing links enables rapid and accurate work to be done. An ingenious attachment for turning cross heads in the lathe was also noticeable. A machine for flanging boiler and tank work by pressure will soon be constructed at these shops, which is calculated to save a great deal of labor. In the blacksmith shop, which has three steam hammers 500 lbs., 600 lbs., and 2,000 lbs. respectively, foreman Wheatley has constructed a large variety of formers for forging tools and parts required about locomotives and cars. Old tires are forged into wrenches, hammers and other tools that save money compared with their cost price in market. Wearing parts of the Miller coupler are faced with steel, thus increasing strength and durability. Switch rod-heads are forged with a former without bending them over. All freight car work is punched instead of drilled. The air was comparatively free from gas and smoke in the blacksmith shop when we called. A ventilating arrangement, consisting of a large pipe extending through the shop with funnel openings at intervals and with an exhaust fan working at one end, has been tried when cold weather necessitated the closing of doors, but the results were not satisfactory.

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MINNEAPOLIS & ST. LOUIS RAILWAY COMPANY.

Locomotive Statement for the Month of.....18.....

Engine No.	Engineer	Builder	Cylinder: Diameter	Cylinder: Stroke	Drivers: Number	Drivers: Size of Center	Weight	Miles Run: Pass'r	Miles Run: Freight	Miles Run: Work	Miles Run: Switch'g	Miles Run: Total	Fuel: Tons Coal	Fuel: Cords Wood	Fuel: Cost	Stores: Pints Lub'tg Oils	Stores: Pints Illum'g Oils	Stores: Lbs. Waste	Stores: Cost	Repairs: Labor	Repairs: Mater'l	Repairs: Total	Total Cost of Repairs, Stores and Fuel	Cost Per Mile Run For: Fuel	Cost Per Mile Run For: Stores	Cost Per Mile Run For: Repairs	Cost Per Mile Run For: Total	Miles Run to: One Ton Coal	Miles Run to: One Pint Oil	Average Loaded Cars per Draught: Pass'r	Average Loaded Cars per Draught: Freight	Pounds of Coal per Car per Mile	Class on: Fuel	Class on: Oils	Class on: Engine No.	Remarks.

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It is believed that the collapse of the New Orleans exhibition will have a bad effect on South American trade, unless some efforts are made to counteract it. It is said that many goods shipped to New Orleans for exhibition remain in the warehouses for want of money to pay charges. The latest proposition is that these goods be removed to New York for exhibition.

"The friction of an insurance policy on unproductive property" is the latest reason given for a good many fires in flouring mills.

AMERICAN MACHINIST

PUBLISHED WEEKLY

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, APRIL 3, 1886.

CONTENTS.

	PAGE
Automatic Feed Pump and Receiver	1
New Printing Press	1
New-Laying a "Slick." By James F. Hebart	2
Machine Shop Time and Cost Accounts. By A. J. Shaw	3
Furnace for Heating Long Bars. By W. G. Richards	4
Good Nature	4
Guide Bar Oiler	4
Electricity for Practical Mechanics. By Geo. H. Benjamin	4
Profit-Sharing by Employes	5
The Tabor Revolution Counter	5
Moulding Bells for Blast Furnaces in Green Sand Without Patterns. By Geo. O Vair	5
Wooden Emery Wheels	5
Pattern Making. By F. W. Barrows	6
Letters from Practical Men—Some Handy Shop Tools—Engine Bearings. By Wm. H. Hoffman—Providing a Center for Drawing Circles. By Wm. H. Weightman—A Disclaimer. By John E. Sweet	6
Railroad Shop Matters in Minneapolis and Brainerd	7
Under and Over-Bidding	8
Sinking of the Oregon	8
Inspection and License Laws	8
Literary Notes	8
Questions and Answers	8
Manufactures	9
Machinists' Supplies and Iron	10

Under and Over-Bidding.

A case occurring within the past few months has been brought to our notice by two or three machinery establishments, in which the bids for a 100 H.P. steel boiler, to be provided with the regular fittings, ranged all the way from $850 to $2,800. Most of the bids were from representatives of establishments in good standing, and, so far as we can learn, all were bidding substantially in accordance with the specifications. A circumstance of this kind naturally suggests an undesirable state of things as prevailing in the trade in which it occurs.

Many intimations have come to us to the effect that the "hard times," of which for some time past we have been hearing less and less, show a greater disposition to linger in the engine and boiler trade than in almost any other department of the machine business, at least so far as prices and profits are concerned. But it is remarkable that the complaint in this branch almost entirely relates to prices, and not to volume of sales. In a recent issue we commented upon a gradual change now going on in the engine business, involving the more or less complete substitution of the automatic for the ordinary types of engines, and it may be that this condition of things in some degree influences the general situation as to both the engine and boiler trades.

In estimating the situation, as it is revealed by an instance of bids varying so widely as we have mentioned, a number of considerations should be taken into account. That the occurrence shows the trade to be in an unhealthy condition is apparent, but it by no means follows that the surface impression is the correct one. If it were made clear that the higher bids in such a competition ranged about on the basis of a fair price for a well-constructed machine of the size required, the statement that the bids ran down to one-third of that figure would necessarily indicate one of several things. It might indicate that the case in question was wholly exceptional, that a number of concerns were over-anxious to secure a particular order, excess of emulation having worked a result such as sometimes induces auction buyers to disregard values. It might indicate that this line of trade was badly demoralized throughout; or it might indicate a smattering of each of the foregoing explanations as the true one. Taken in connection with the want of complaint, or the small amount of complaint prevalent regarding volume of sales, the more probable suggestion, however, is likely to be about as follows: One or two parties were over anxious to make sales, bidding too low, so that getting a few more such orders may possibly induce them to take a more conservative course in future, perhaps with the result of making them over conservative next time. One or two bid at fair living rates; while one or two other establishments purposely over-bid, having, probably, plenty of work in hand and not caring to get this particular order, except at figures that would pay them well, and, perhaps compensate for some interference with other business.

If this view of the case should prove to be the correct one, it would show the engine and boiler trade in a light not very favorable, but far from desperate. It would also suggest to establishments engaged in the business of furnishing power to manufacturers that, with a fair quota of orders coming in, reasonably remunerative prices ought soon to be obtained.

Sinking of the Oregon.

The sinking of the steamship Oregon is another instance of how imperfectly arrangements designed to secure safety may serve their purpose in emergencies. Happily the accident occurred where assistance was at hand, otherwise frightful loss of life would have resulted. The popular impression is that modern steamships constructed with several water-tight compartments will continue to float, even with a big hole in their sides. The fact in this case seems to be that a collision with an insignificant schooner was sufficient to sink one of the largest and staunchest steamships afloat, embodying the most advanced ideas in steamship construction. It may be that the water-tight compartments delayed the sinking, thereby giving time for the transfer of passengers to other vessels which came to their relief, but they did not, as it is popularly supposed they would do, prevent the final sinking. If the accident had occurred in mid-ocean it is reasonably plain that but few of the passengers would have escaped with their lives. But the timid may console themselves with the fact that such accidents are not likely to occur except near shore.

Only a short time since, vessels of the type of the Oregon were chartered by the English Government as a valuable addition to the navy in the event of probable war. It is evident that their chief utility would have been in their speed. The 13,000 horse-power engines of the Oregon would have enabled her to have kept out of reach of any modern war ship.

No more valuable faculty can be possessed by a mechanic than that of being able to readily and lucidly convey ideas to another. Many men otherwise competent to direct others have failed from lack of this faculty, or have refused good positions because they knew their weakness in this respect. Perhaps as many foremen fail from this cause as from any other. Undoubtedly, this faculty is one to be acquired; it is not one, if there are such, that is born with a man. Every man who works at a mechanical business should labor in the direction of acquiring the habit of concisely expressing his ideas, making this a part of his mechanical education. The time is always likely to come when he will have use for this knowledge. Talking of such subjects will help a man; writing of them is excellent practice.

If the average loss of life and disabling of trainmen on railroads has any connection with compensation for services, it is probable that they are the poorest paid men in the world. And the cause of this reckless expenditure of life is largely due to the refusal of railroad corporations to use safety appliances already perfected. This and sometimes the systematic over-working of trainmen on some roads, are responsible for the loss of life which makes train service next perhaps to military service in time of war, the most hazardous known.

Inspection and License Laws.

Accounts of boiler explosions come along with great regularity; carelessness and incompetency, in nine cases out of ten seem to be at the bottom of them, yet it seems impossible to make much progress towards remedying the trouble by extending the operation of license and inspection laws. The frequency of such catastrophies may have something to do with the failure to secure attention to the proper remedies, for it seems that it must be a lack of attention to the subject that presents the universal application of remedial laws. We do not believe that if by any means the attention of every man in the country could be turned in the proper direction for ten minutes, there would be any lack of suitable action in the matter. There is really no good argument against such laws. Comparatively few men who have use for steam boilers know much about them; owners would if they stopped to think of this matter, see the advantage of inspection by those competent to judge of their condition. It would often save them serious trouble and expense, and always give them a greater sense of security.

So far as license is concerned there is no intention to set up a monopoly. All that is required is that an engineer possess sufficient knowledge and intelligence for his duties; how this is obtained is immaterial. No honest man would desire to put a boiler in charge of an incompetent man, thereby endangering life. The enactment of general inspection and license laws, and their enforcement, are measures against which no fair-minded man will be likely to argue.

Literary Notes.

The *Cornell University Register* is the title of a 192-page pamphlet, which contains information relating to organization and government of the University. A list of officers for the year 1885–86, a description of the material equipment, courses of study, and a description of the prizes, honors scholarships and fellowships which are conferred by the University, together with the conditions of admission and classification of the students; also a statement of the expense of residence and graduation.

Considerable other information is annexed, such as lists of graduates, catalogue of students and associate alumni, and a copy of examination papers for entrance and scholarship.

This *Register* will be mailed to any address upon application to the treasurer of the University, Ithaca, N. Y.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(134) If Lathe Spinner, who asks information about spinning, will send full post-office address we will communicate with him by mail.

(135) A. C., St. Paul, Minn., asks: Is it possible to buy a good steam tricycle? *A.*—We are not aware that any one makes steam tricycles for sale. We do not know of any that have been proposed that we could recommend.

(136) R. H., Birmingham, Ala., asks: Can you tell who first made use of the idea of running the exhaust from a steam pump into the suction, and when? *A.*—It is on record that Henry R. Worthington did this in 1850. We do not know whether or not he was the first to do so.

(137) J. E., Woburn, Mass., asks several questions in relation to proportion of cylinders and valves. He will find information that will enable him to determine these proportions for himself in the AMERICAN MACHINIST of Aug. 16 and 30, Sept. 6 and 27, Oct. 4 and 11, 1884; Sept. 5, 12 and 26, Oct. 10 and 24, Nov. 7 and 21, and Dec. 12, 1885.

(138) G. L., Pullman, Ill., asks: 1. In a tensile test of boiler plate, what should be the per cent. of elongation in 5″ in length? *A.*—About 20 per cent. 2. What should be the reduction of area? *A.*—Not less than 30 per cent. 3. What should be the elastic limit? *A.*—About one-half the tensile strength. These figures are subject to considerable variation, but are the best we can give.

(139) J. H., Allegheny, Pa., writes: "I am running an emery wheel which does not run true. The bench shakes badly, and in grinding axles I cannot get them true. Is it my fault? *A.*—It is useless to expect good work from an emery wheel unless it runs true, and is in good condition. In the AMERICAN MACHINIST of January 24, 1885, is an article which fully covers this subject.

(140) T. A., Bristol, Pa., asks: 1. Can 1¼″ round machinery steel be welded, and be considered a strong job? *A.*—It can be done, but we would not warrant such a job to be as strong as a similar bar *not welded*. 2 Which is the best kind of brass for bearings, hard or soft? *A.*—It depends much upon the character of the work to be done. As a general rule, hard brass is used. 3. Will soft brass wear a journal quicker than hard? *A.*—No; but the brass will wear down quicker.

(141) J. B. W., Cleveland, Ohio, asks: Why does a piece of hardened steel, 4″x2″x½″, spring in grinding the surface? Having ground one side true, turned it over and finished the other side, I finished the edges; on testing it, I found it sprung, one side concave, the other round. What is the reason? *A.*—Steel, as well as iron, often changes shape when the surface metal is removed. It may be caused by internal strains, which, being set free by grinding, exert their power and cause the effects noticed. Local heating may have something to do with it.

(142) J. W. L., Worcester, Mass., writes: What power is there in 200 gallons of water per hour at 50 lbs. pressure, not allowing for friction, and assuming that we get 100 per cent? *A.*—To find the power of a fall of water, we "multiply the volume in cubic feet per minute by 62.5 (the weight of a cubic foot of water), and this product by the vertical height of the fall in feet." 200 gallons per hour is equal to 2⅔ gallons per minute, and occupies 845.46 cubic inches, or about .5 of a cubic foot, which, multiplied by 62.5, and again by 108 (this height of water corresponds to a pressure of nearly 50 lbs.), we obtain as a result 3,850 foot-pounds, or about 1-10 horse-power.

(143) J. C., New York, asks: How can I compute the cubic contents of a triangular tank 5′×5′×3′, and 16½″ deep. *A.*—First determine the distance from the point where the two 5′ sides meet to the center of the 3′ side. You now have a right angle triangle, given base (3′) and hypothenuse (5′) to find the perpendicular square the two sides and their difference equals $25 - 9 = 16$. The square root of which (4) equals the dimension desired. You now have two equal right angled triangles, the sides of which are 3, 4, and 5 feet, respectively, and their area is equal to the product of $3 \times 4 = 12$ feet. To obtain cubical contents, we multiply by depth, 16½ inches. The result (198), when divided by 12 to reduce to cubic feet, is 16.5, the answer desired.

(144) H. C., Minneapolis, Minn., asks: Which travels the fastest, the crank-pin or the piston of an engine, and why? *A.*—Take your dividers and describe a circle, which call the path of the crank-pin. The diameter of the circle will then represent the stroke of the piston. A little consideration will show you that while the crank-pin is traveling entirely around this circle the piston will travel a distance equal to twice the diameter. As the circumference of a circle is equal to 3.1416 times its diameter, you will readily see that the mean speed of the crank-pin must be greater than that of the piston. You will find in the AMERICAN MACHINIST of Feb. 16, and March 8 and 15, 1884, matter that will answer your questions about measuring diagrams.

(145) W. G., Greenville, S. C., asks: 1. Give me a rule for diameter and height of iron smoke-stack. *A.*—You can apply the same rule to an iron smoke-stack that you would to a brick chimney, for which see AMERICAN MACHINIST of March 27. 2. If I have an engine 7″x12″ making 150 revolutions, then if I double the speed with same boiler pressure, will I double the power and will the same boiler supply steam? A.—If the engine is doing all the work possible at 150 revolutions, it is not probable that at double the speed you would quite double the power, because at the higher speed it is not likely you will be able to get as near boiler pressure in the cylinder. It will depend largely upon the size of steam ports and character of valve motion. If you double the power you will require, approximately, double the quantity of steam; if your boiler is only just large enough at 150 revolutions, it will be too small at 300 revolutions.

(146) C. H. C., Rockford, Ill., asks: How can I make horseshoe magnets? What is the best material for them, and how are they magnetized? *A.*—Horseshoe magnets are made by bending to form before magnetizing. They require some change of shape after magnetism is imparted, or it will not be permanent. This change may be made by grinding or filing. Sometimes a blow from a hammer will have the effect of making permanent the magnetism. The very best cast steel is required for magnets. A special brand is used and sold by dealers for the purpose of making magnets. Magnets may be magnetized in two ways; by rubbing with another magnet, taking care to draw from the bend towards the ends of the magnet, and always keeping the same poles in contact. The best method is by placing the steel in the coil of a helix, which consists of a coil of insulated copper wire. When an electric current is passed through the wire, the steel enclosed by the coil becomes highly charged, and makes a much stronger magnet than is possible by use of other magnets.

(147) A. M., Jersey City, N. J., writes: I want to build a large chimney. The ground is soft, and I have to drive piles. If I have a 1,200 ram-block, when it falls 25 feet or 1 foot, what weight will the pile bear without settling further? *A.*—We suppose you want to know what weight a pile driven by a 1,200-lb. hammer will hold. A rule given by Trautwine is: "Multiply together the cube root of the fall in feet, the weight of hammer in pounds, and the decimal .023. Divide the product by the last sinking in inches, plus 1. The quotient will be the extreme load that will be just at the point of causing more sinking. For the safe load, take from 1-12 to ½ of this, according to circumstances." Twenty feet is enough for the drop of your hammer for the last few blows. Suppose you drive the pile until at the last blow it sinks, say 3 inches, then, according to the above, you have for extreme load the cube root of 20 (2.7) multiplied by the weight of the hammer (1,200 lbs.), and the decimal .023, and this product divided by $3 + 1$ (4), or

$$\frac{2.7 \times 1200 \times .023}{4} = 18.6 \text{ tons},$$

the load that will just cause the pile to settle lower. Allowing a safe load to be ⅓ of this, you have, say 6 tons, that such a pile will safely support.

(148) A. W. C., New Iberia, La., asks: 1. Does a locomotive hauling, say ten cars, consume less coal and evaporate less water when running 45 miles per hour than when running 60 miles per hour? *A.*—Yes. Materially more coal and water will be required at 60 miles. 2. In a long valve, the two parts held in position by jamb-nuts, how shall I measure the lap? *A.*—Place the valve at the center of its travel, and measure the lap precisely as if it were a short valve. 3. The center of main shaft is 20″ below line of motion of slide-valve. How shall I find the relative position of eccentric to shaft? *A.*—We can only say that you must take the central line of motion of valve as distinct from central line of motion of crank and lay off angles for eccentric from the former, with crank on the center. 4. We are using very bad well water, and I intend laying pipe 1⅛ miles to the river. The level of water in the river is 18 feet below the engine room floor, so, to enable feed pump work. I propose to put it 14 feet below the surface. Will it work? *A.*—If you propose to draw the feed from the river, it will not work. Notwithstanding you sink the pump, it will have to lift the water over the intervening elevation, which, with the long pipe, it will not do.

(149) Machinists, Sag Harbor, N. Y., ask: 1. Does the weight of a train of cars, passing a curve, come upon the inside or outside rail? *A.*—If the outside rail is sufficiently elevated to correspond with the radius of the curve, and the train passes at just the right degree of speed, then the weight upon both rails must be equal. If either of the above conditions be changed, the weight of train will be distributed differently, and either rail may receive a majority of the train weight. 2. Does the top or bottom of a locomotive engine wheel travel the fastest? *A.*—Country lyceums will argue all night upon this old question, and the answer, if correctly given, would be of no value. 3. Does the crosshead of a locomotive, in motion, ever "come back," the locomotive, of course, going ahead? Is not the crosshead always going ahead, and the locomotive going up to it? *A.*—The value of this question is of little moment to the mechanic, but if we take as an example a 6-foot drive-wheel, and 24-in. stroke, we see that while the crosshead is making its backward stroke of 24 in. the locomotive advances one-half the circumference of the driver-wheel, or about 9.4 ft., therefore the crosshead can never pass backward over a given point on the rail. 4. Does it take any more pickets to build a fence to go over a hill than it does on a level between the same points. *A.*—No more pickets will be required, provided they are placed equal distances apart in both cases, but a greater number of rails and posts will be needed.

(150) B. N. S., Chicago, Ill., writes: I am advised to use barley sprouts for the purpose of preventing scale in several small locomotives in which I am using very hard lime-water. What virtue is there in barley sprouts? *A.*—The value of vegetable matter as scale preventives in steam boilers depends upon the acids which they contain, or in case of potatoes or starchy compounds, they seem to act mechanically, by enveloping the solid particles and preventing their adhesion to the boiler plates. Gall-nuts, logwood, hemlock, mahogany, etc., act through the tannic acid they contain. Molasses and vinegar, and other articles, owe action to acetic acid, which is dangerous, if present to excess. Barley sprouts probably contain more or less acetic acid, but doubtless owe the greater part of their action (if they have any) to the starch which they contain. 2. Does the lime float on top of the water, or sink immediately? *A.*—Carbonate of lime is held mechanically in suspension for a time, and then settles to the bottom of the boiler. Sulphate of lime, or "plaster-of-Paris," is twice as heavy as water, and at once sinks. Carbonate of lime, when treated in the boiler or heater with tannic acid, become decomposed into tannate of lime. It is then lighter than water, and may be removed by the surface blow-off.

(151) F. R. H., Jersey City, N. J., asks: 1. In a vertical boiler 66″ diameter, with 2″ tubes 48″ long, at what height is it most economical to carry the water? *A.*—This can only be determined by experiment. Probaly at about 16″ above crown sheet. 2. Our engine works at about 6 horse-power, taking steam through an 1½″ pipe. The engine runs 300 revolutions. Would this steam pipe answer if the speed of engine were reduced to 120 revolutions, developing the same power? *A.*—Yes. The pipe would be proportionately larger at the slower speed. 3. In case of pulleys from 22″ to 26″ diameter, centers being 9 or 10 feet apart, would you use straight-face or crown-face pulleys? *A.*—We should use pulleys with faces slightly crowned. 4. Is it not more a matter of opinion than anything else as to the amount of oil to be used in a cylinder, and regulating this by the drops through a sight-feed cup? *A.*—It is a question of observation. You find what quantity of oil will keep the cylinder from "calling for oil," then you can soon determine how many drops per minute will feed this amount. 5. In calculating the horse-power of a vertical boiler is it right to calculate all the surface inside the tubes, or only that covered by water? *A.*—It is customary to calculate all the tube surface, then, by experiment, carry the water anywhere above 12″ over crown sheet that will give best results. 6. Which is better, leather or rubber packing for steam pipe joints? *A.*—Rubber. 7. Is it not better to scrape a slide-valve and its seat to a surface-plate, than to scrape the valve to its seat? *A.*—In our opinion, the best plan is to scrape both valve and seat to surface-plate, then try the two together, and, if necessary, do a little more fitting by scraping.

(152) E. Rector, Rockport, N. Y., writes: What would be the force, in pounds, exerted by a lever weighing 108 lbs., which is 9 ft. 11 in. in length, the fulcrum being 7 in. from the short end of the lever, and a weight of 104 lbs. suspended 7 ft. 2 in. from the fulcrum; also, what force would the lever exert by its own weight, and what is the rule for computing the force exerted by a lever having weight and position of fulcrum given? *A.*—The last question is covered by the general rule that as the length of the "short end" is to the distance from fulcrum to the center of "effect," or center of gravity of the long end of the lever; so is the weight of the unbalanced portion of the lever to the weight which will be suspended at the "short end." For instance: We will assume a lever 12 ft. long, and weighing 12 lbs. If we place this lever with its center upon a fulcrum, it is plain that it will exactly balance, and no force will be exerted over. If we now move the lever until the "short end" is 2 ft. long, it is evident that 6 ft. of the lever will balance itself upon the fulcrum, leaving 6 ft. to act as weight weighing 6 lbs., but at a point midway of its length, or just 6 ft. from the fulcrum. Here, then, we have the condition of a 9 ft. lever, a weight of 6 lbs. and the fulcrum 3 ft. from the end, and the weight balanced would be as 2 to 1, or 12 lbs.; exactly the weight of the lever. Place the fulcrum at 2 ft. from the end of the lever. Now, we have 8 ft. unbalanced, the "center of effect," or gravity, is 6 ft. from the fulcrum. As two-thirds the lever is unbalanced, the effective weight is two-thirds the whole weight, or 8 lbs.; the length to and beyond fulcrum is 2 ft. and 6 ft., therefore the force exerted is $\frac{6}{2} \times 8$, or 24 lbs. In the case of the lever weighing 108 lbs. the fulcrum being 7 in. from the end, total length, 9 ft. 11 in. we may figure as follows: Total length, 119 in. The 7 in. beyond fulcrum will balance 7 in. on the other side of the fulcrum, leaving 105 in. of unbalanced lever, equal to a weight of $\frac{105}{119}$ of 108, or 95.29 lbs., at a point $52.5 + 7 = 59.5$ in. from the fulcrum. We now have the problem reduced to a lever 7 to 59½, or 1 to 8½; therefore the force sustained will be $8\frac{1}{2} \times 95.29$, or 809.965 lbs. If a weight of 104 lbs. be placed 7 ft. 2 in., or 86 in., from the fulcrum, we have a simple lever of

$$\frac{7}{86} = 12\frac{2}{7}, \text{ or } \frac{1}{12\frac{2}{7}} \text{ to 1.}$$

Multiplying 104 by 12 2-7, we obtain a leverage of 10,637⅛ lbs., which, added to the force exerted by the lever alone, is $10{,}637.7142 + 809.965$, which is a little more than 11,447 lbs.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Power measured.–F. Van Winkle, 22 Cortlandt, N. Y.

Alt, Mechanical Engraver on Wood, 318 B'way., NY

T. M. Parker, Steel Stamps, Stencils, Hartford, Ct.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 48 Beekman st., N. Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

Tack and Wire Nail Machinery, made by the Willets Mfg. Co., Providence, R. I.

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"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John st., N. Y.

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E. Merritt & Co., Brockton, Mass., established 1859, only manufacturers of a complete line of Tack and Nail Machinery. Send for circulars.

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10,000 users machinery, tools, steam engines, boilers, etc., in N. Y. & N. J. Best *Trade Directory* ever issued. Send for circular. J. N. Mills Pub. Co., 30 Vesey st., N. Y.

The lead fillet referred to by a correspondent in the MACHINIST of March 27th, as being the best, is manufactured by Howard White, 44 N. 4th st., Philadelphia, Pa. Send for circular.

Bound Volumes of the AMERICAN MACHINIST for the years 1880, 1881, 1882, 1883, 1884 and 1885. These volumes are strongly bound in cloth, and will wear well. Price $3.50 each; express charges additional. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

"Locomotive Engine Running and Management." By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air-brake explained by aid of engravings. Price, $2. For sale by Angus Sinclair, 175 Dearborn street, Chicago, Ill.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for 5 or more copies.

MANUFACTURES

A new foundry will be built at Plymouth, N. C.

A flour mill is to be built at Alexandria, Tenn.

A machine shop will be built at Water Valley, Miss.

The Pittsburgh (Pa.) Locomotive Works are to be enlarged.

E. B. Sexton will build an iron foundry at Baltimore, Md.

Sharpless & Co. intend to build a nail mill at Chester, Pa.

The boiler works of P. J. Gebney, Mobile, Ala., are to be enlarged.

A company has been organized at Fairfield, Me., to introduce electric lighting.

N. R. Streeter & Co., Rochester, N. Y., expect to double the capacity of their foundry.

Putting in new machinery in the Newberry (N. C.) cotton mills is in contemplation.

A four-story tobacco factory is to be built at Lynchburg, Va., by Karn & Hickson.

Water-works are to be built at Fernandina, Fla., by the Florida Railway and Navigation Co.

P. W. Lownes, Orlando, Fla., will increase his plant by adding a foundry to his machine shop.

L. S. Crandall intends to start a factory for the manufacturer of type-writers at Parish, N. Y.

The Pawtucket Valley Machine Works, Pawtucket, R. I., are running nights till nine o'clock.

Joseph Bancroft & Sons, Wilmington, Del., will enlarge their machine shop and put in new tools.

P. H. Somerset will build a four-story factory on Eleventh street, above Market, Philadelphia, Pa.

Bradley & Co., Richmond and Ash streets, Philadelphia, Pa., will soon build an iron chain factory.

W. N. Rumley, Laporte, Ind., is manufacturing a very convenient section liner for the use of draftsmen.

The Mayo Ice Factory, Orlando, Fla., is to be rebuilt. It was recently damaged by a boiler explosion.

New buildings will be erected at the factory of the Tennessee Furniture and Chair Company, Union City, Tenn.

The Edison Electric Mfg. Co. will erect a large factory and foundry at North Tenth and Third sts., Brooklyn, N. Y.

The Fairbanks Manufacturing Co., Springfield, Ill., has been incorporated to build the Fairbanks sewing machine.

The rolling mills at Toledo, Ohio, known as the Maumee Mills, will start up April 1, after an idleness of two years.

James M. Haffen will erect two engine and boiler houses on 152d st., between Cortlandt and Third avenue, New York City.

The Boynton Company have purchased land in Lafayette, N. J., and will erect an extensive foundry early in the spring.

W. B. Morse will build a five-story building for manufacturing purposes 90x125 feet, on West Main street, Rochester, N. Y.

Henry C. Lea will erect a large building for manufacturing purposes on Arch, corner of Seventh street, Philadelphia, Pa.

The Stillwell & Bierce Manufacturing Co., Dayton, Ohio, have recently made shipments of water-wheels to Russia, France and Australia.

The Syracuse Stove Co., Syracuse, N. Y., will enlarge their buildings and put in a 40 horse-power engine, together with a 60 horse-power boiler.

C. M. Robertson, Montville, Conn., has bought the machinery in Boorum & Pease's paper mill, Elm street, New York, and will remove it to the former place.

The building which is to be erected at the State Fair Grounds, East Des Moines, Iowa, and used as a "machinery hall," will be 130x64 feet, with a "power shed" annexed, which will be 160x64 feet.

The new Washington Mills, at Lawrence, says the *Manufacturers' Gazette*, will be splendid and immense. They will be run by steam power, this being regarded as cheaper than water. There are to be three buildings of 300x75, 407x100, and 428x100, each five stories. All the floors will be on the same level, and the raw material taken into one of the great factories will go through the various processes there, and pass around, on railways, into the other great mill, and thence, finished and boxed, into the railroad cars. The manufactures will be of cotton, wool and worsted dress goods, for gentlemen's and ladies' wear.

The Bucyrus Foundry and Manufacturing Company, Bucyrus, Ohio, write us: "We are so rushed with orders that we hardly know which way to turn. We are increasing our facilities as fast as possible and have ordered quite a large amount of new tools, which will nearly double our present capacity. We have a number of orders for steam shovels and dredges, and within a short time have shipped a steam shovel to San Francisco, and will have another to go to the same place shortly. We are also enjoying a good trade in our mine cars, mine car wheels and axles, and other mine supplies. We number ourselves among the 'optimists' now, and have great faith in the revival of business and the 'good time coming.'"

Machinists' Supplies and Iron.

New York, March, 18, 1886.

The market has been steady and quiet. Supply dealers are active in their efforts to secure business, and manufacturers are willing to work at small profits.

Iron—In American pig the contract deliveries nearly absorb production, and other purchases are small for immediate use. No. 1 X, Foundry, at tide water, $18.00 to $18.50; Standard, Lehigh and North River, $17.00 to $17.50; Grey Forge, $16.00 to $16.50.

Scotch Pig—Quiet and steady. Coltness, $20.25 to $20.50; Glengarnock, $19.50; Gartsherrie, $19.00 to $20.00; Summerlee, $20.25.

Lead—Quiet at 4.90c.

Copper—Moderate demand. Lake, 11¼c.

Tin—Banca, 22¼c.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Correspondence with parties wishing manager or supt. Address, R. G., Am. Machinist.

Foreman pattern-maker would like re-engagement April 1st. Address Foreman, Am. Machinist.

A first-class mechanical draftsman, thoroughly acquainted with the details of engine work. J. P. H. Am. Machinist.

Wanted—A first-class pattern-maker; must thoroughly understand working from drawings. Address, X. Y. Z. Am. Machinist.

Wanted—A situation as a brass finisher; have had six years' expertence; best of references as to character and ability. Address B. F., Am. Machinist.

Wanted—A thorough machinist, of pleasing address, wants to travel, representing a first-class machine manufacturer. Address A. T. M., Am. Machinist.

I have the drawings for, can make patterns, build and operate wire, nail or tack machines; would like a good position. Address Harrison, So. Abington, Mass.

Situation by a first-class pattern-maker and draftsman; qualified for a position needing the above separately or together; highest references. Address Box 15, Am. Machinist.

Situation Wanted—By a young man in some mechanical business; practical experience, with collegiate education; capable of doing drafting and general office work; correspondence solicited. Address J. L. L., No. 18 N. Calhoun st., Baltimore, Md.

Wanted—A thoroughly competent mechanical draftsman; must have had both theoretical and practical education and experience; prefer a young man and one possessed of ingenuity, tact and ambition. Address, A. B. C. Am. Machinist.

Wanted—A mechanical engineer of fourteen years shop and office experience, and six years theoretical and technical experience, wants position near N. Y. City in some out-door capacity; salary secondary consideration. Mr. Ames. Am. Machinist.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at cents per line, each insertion.

Crescent Boiler Compound; ever reliable, never failing. Crescent Mfg. Co., Cleveland, Ohio.

Light mach'y of all kinds built at short notice. Pennington & Mills, 8 Dey st., Jersey City Heights, N. J.

Machine shop and foundry for sale in a Western city; full or half interest. S. & H., Am. Machinist.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

C. F. Langston & Co., 222 N. 5th st., Phila., can-makers' tools, presses, dies and special machinery built, rotary cutters made and ground.

Wanted—To purchase, interest in some mechanical business in N. Y. City or Newark, N. J.; state fully; "Mechanical Management." Am. Machinist.

For Sale—*Scientific American*, 47 volumes, unbound, January, 1862, to July, 1885. William W. Staples, Wilmington, Del.

For Sale—New Flathers lathe, 20" swing, 12' bed, compound rest, power cross-feed, 1⅝" hole in spindle, $400. Hendey shaper, new, 24", with vise, index centers, and extension table, $430. Address W. E. Taft, 57 Clifford st., Providence, R. I.

Wanted. a good business man, with $10,000 to $15,000, to invest in and take active management of a lucrative manufacturing business situated in the South. For further information, address Box 3, Am. Machinist.

Patentee of a new positive motion four-valve gear for automatic engines wishes to arrange with a party who is in position to manufacture and put it on the market; has been tested. Address, Bucks, Am. Machinist.

Martin Bros., manufacturers, Lock Box 285, New Brunswick, N. J., will contract for the manufacture of articles in brass and other metals (stamped or turned), and dies and tools for making same; also patent novelties, electrical inventions, special machinery castings, etc.; estimates cheerfully given.

Engine and Boiler—30 horse-power Buckeye engine; 42"x12' tubular boiler; all pipes and fixtures, including injector, heater and smoke-stack; the whole in good condition; in use about three years; to be replaced by larger engine, etc., of same make; can be seen in operation until May. 1. Address Geo. A. Barnard, 70 Astor House, New York.

For Sale—Canadian patent of J. H. McGraw's Patent Adjustable Tube and Hose-Coupling Expander, the only adjustable roller expander made to a firm with light machinery; this is a good opportunity; used and indorsed by leading firms in U. S.; price low, as my U. S. business is all I care to attend to. J. H. McGraw, 187 W. 8th st., Oswego, N. Y.

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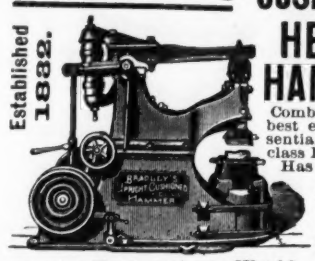
Established 1832.



Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other Hammer in the World.

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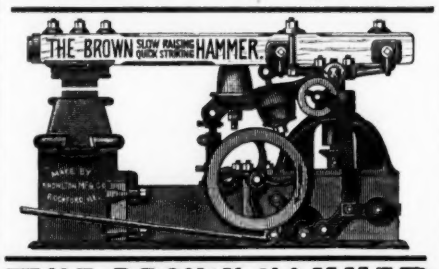

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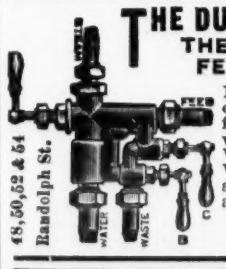
THE DUPLEX INJECTOR
THE BEST BOILER FEEDER KNOWN.



Not liable to get out of order. Will lift water 25 feet. Always delivers water *hot* to the boiler. Will start when it is hot. Will feed water through a heater. Manufactured and for sale by

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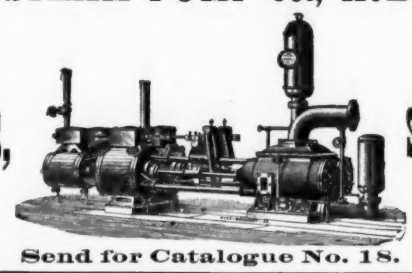

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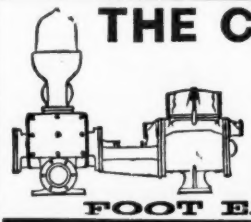

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WARRANTED THE BEST PUMP MADE FOR ALL SITUATIONS.

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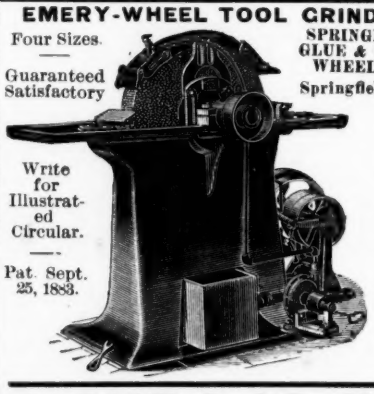

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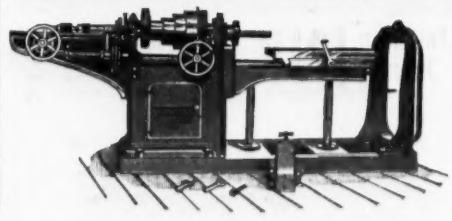

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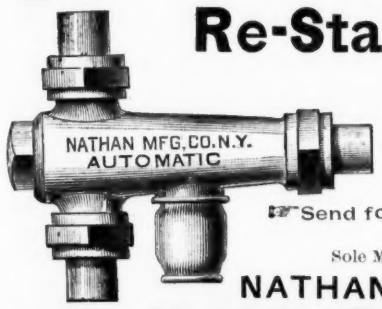

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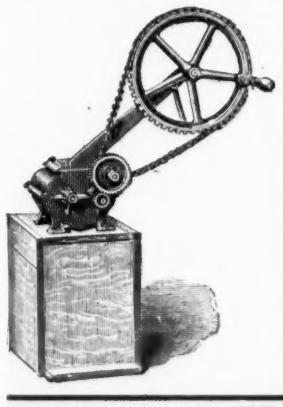

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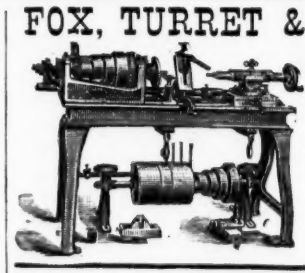

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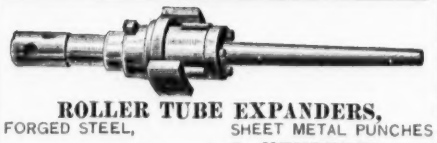

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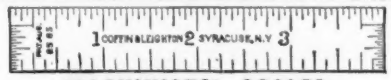

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SIMPLE, DURABLE, EFFICIENT.

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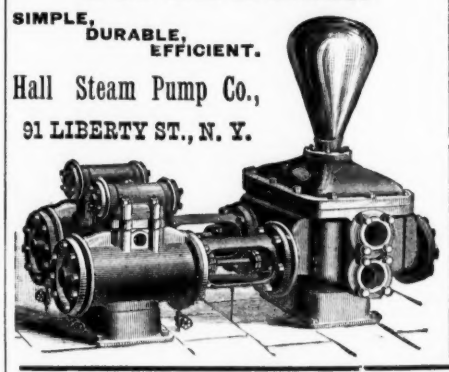

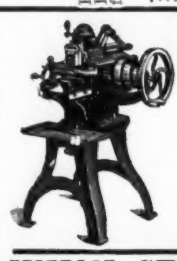

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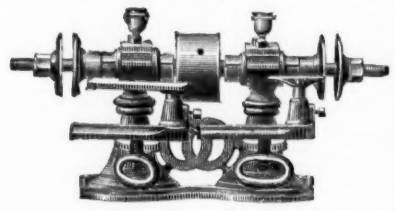

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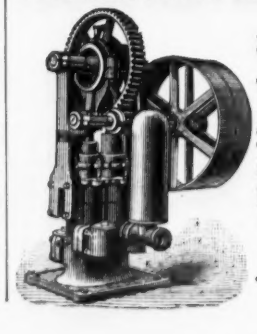

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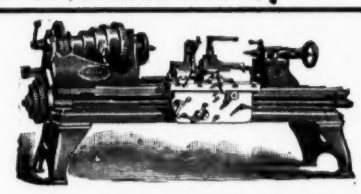

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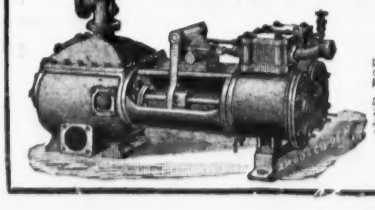

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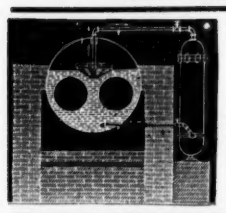

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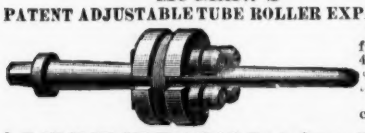

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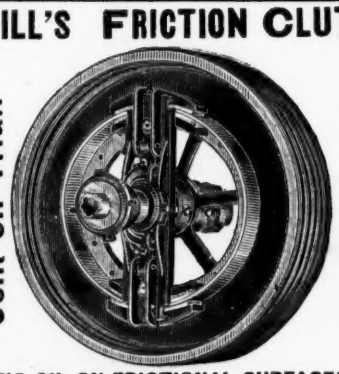

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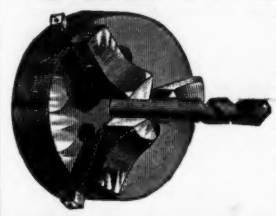

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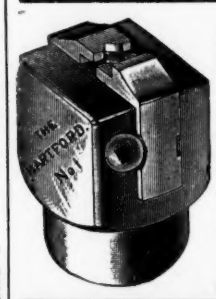

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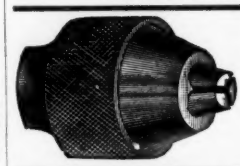

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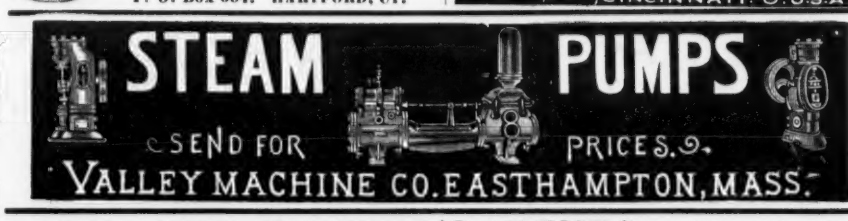

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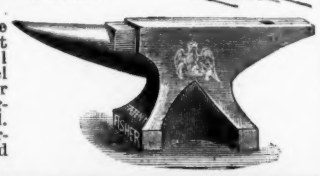

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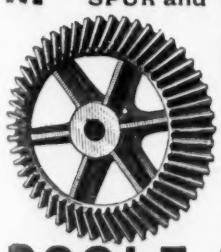

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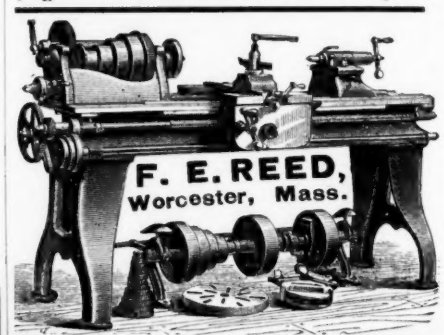

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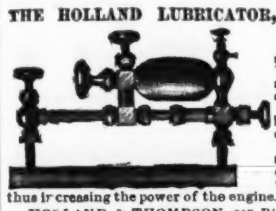

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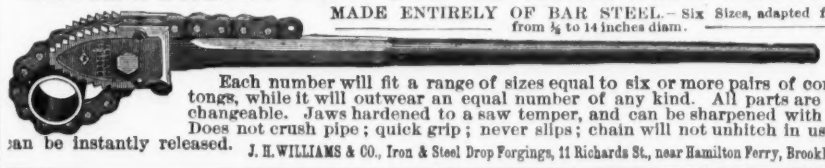

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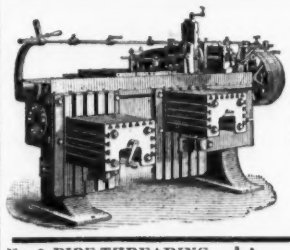

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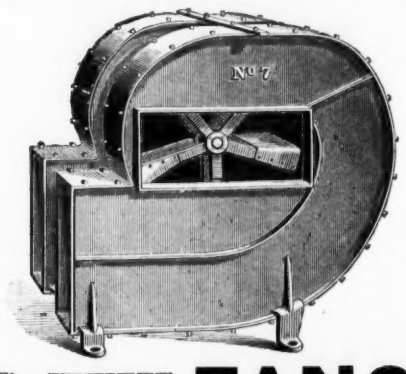

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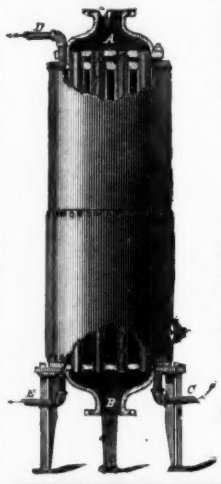

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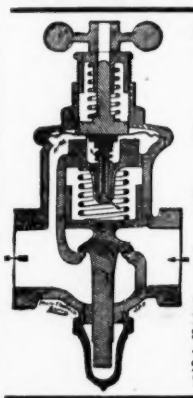

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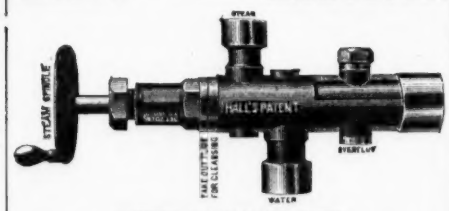

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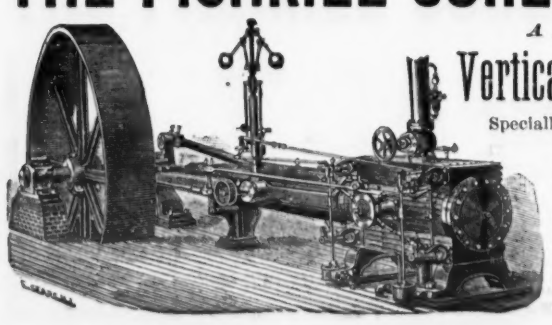

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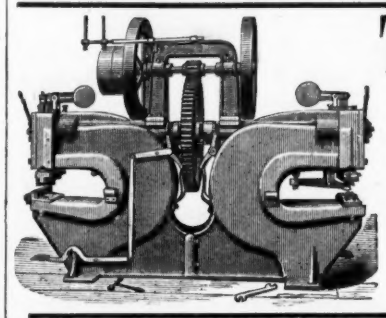

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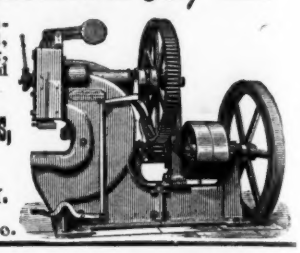

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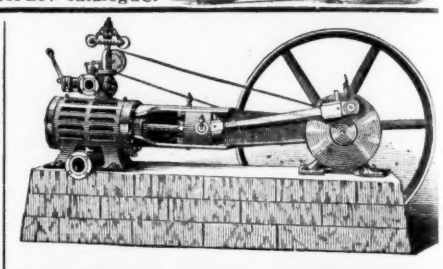

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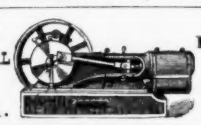

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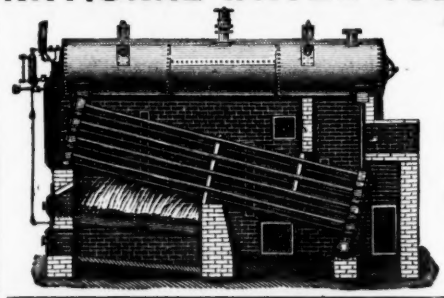

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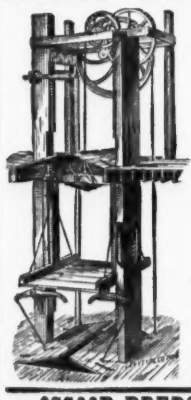

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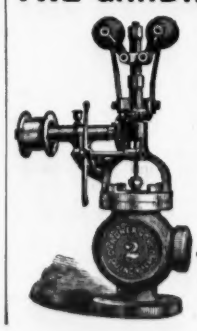

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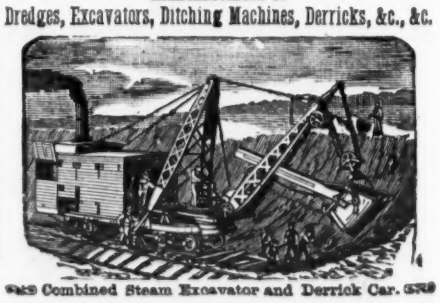

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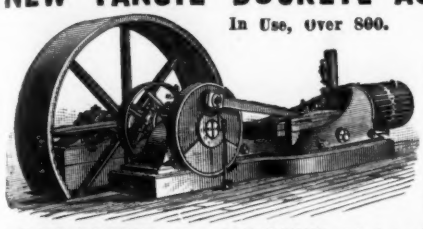

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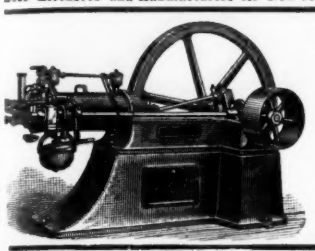

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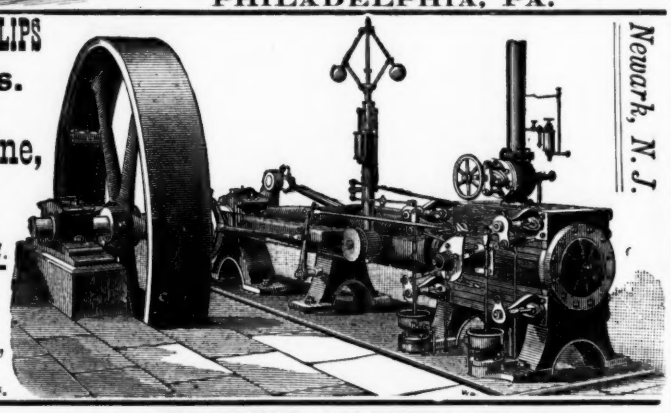

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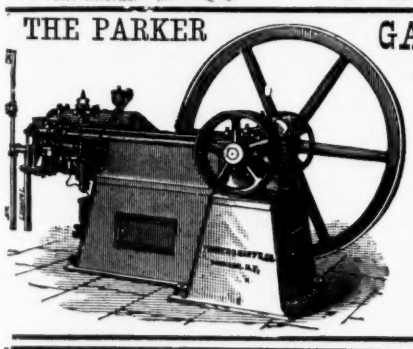

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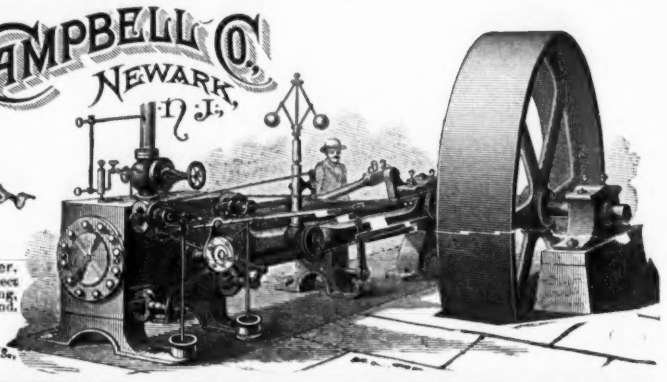

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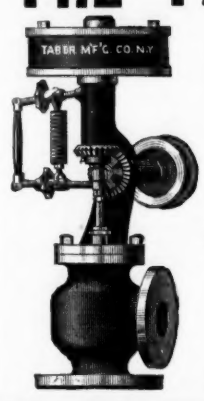

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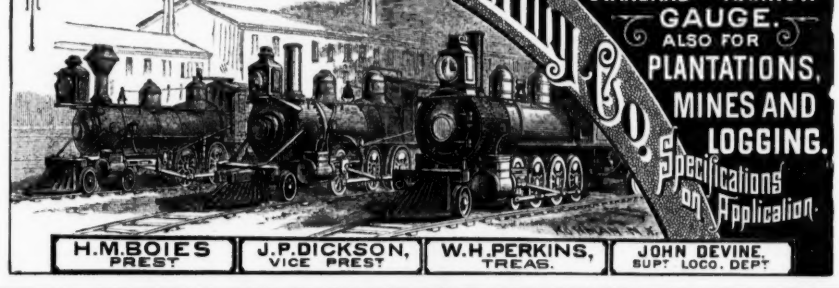

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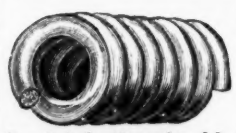

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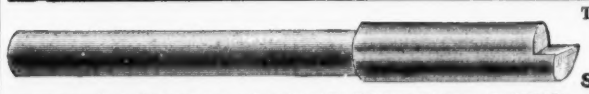

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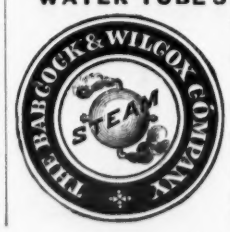

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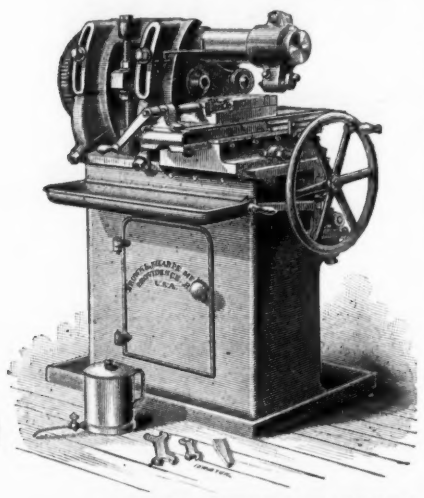

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The Spindle is driven by a gear and pinion from a three-step cone with 3" belt. It has a vertical adjustment of 6".

The Table is 9" wide, 27" long, and has 12" longitudinal and 4½" transverse movement, and is moved longitudinally 2" by one turn of the hand-wheel.

The Feed is automatic with three changes, stopping automatically at any required point.

The Vise has jaws 6⅛" long, 1 7-16" deep, and will open 3⅝".

Counter-shaft has pulleys 10" diam. for 3" belt, and should run about 375 turns per minute.

The Price includes vise, counter-shaft, wrenches, &c., delivered f. o. b. at Providence, R. I. Weight, 2550 lbs

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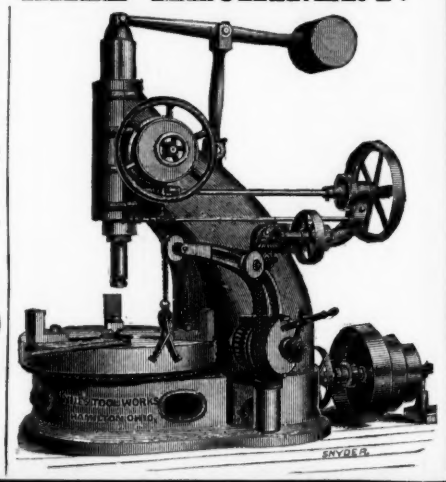

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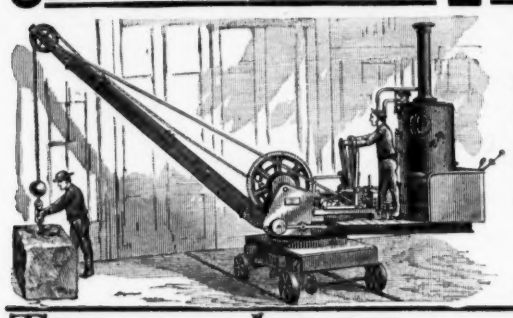

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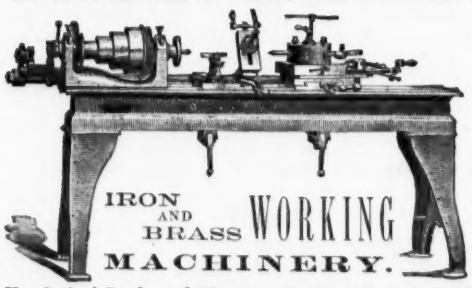

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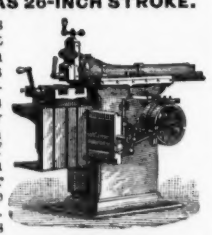

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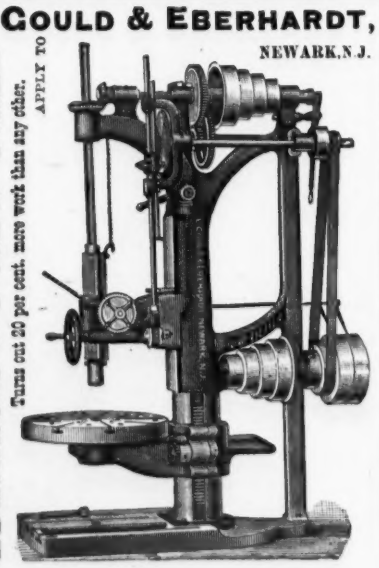

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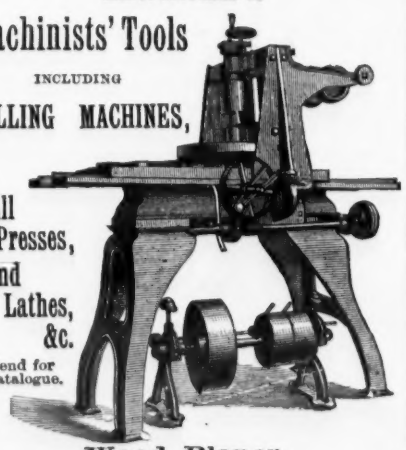

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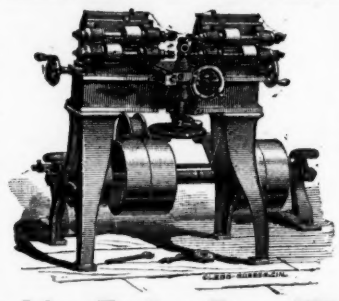

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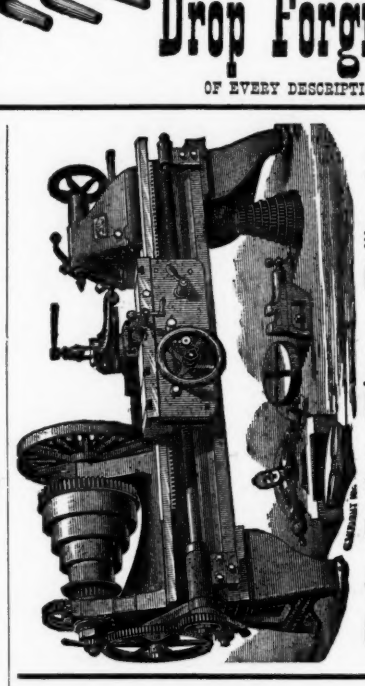

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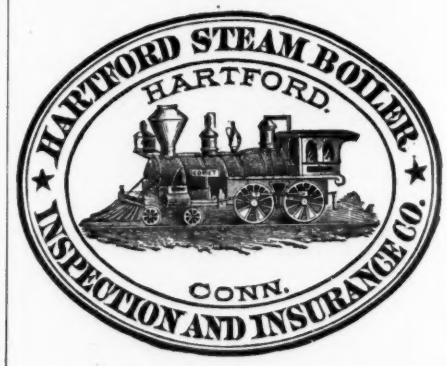

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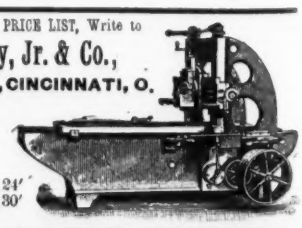

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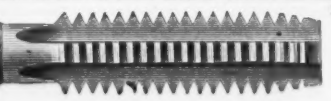

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